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ENCYCLOPÆDIA BRITANNICA.

NICANDER of COLOPHON, a celebrated grammarian, poet, and physician, who lived about the 160th Olympiad, 140 years before Christ, in the reign of Attalus king of Pergamus, who overcame the Gallo-Greeks. He lived many years in Etolia, of which country he wrote a history. He wrote also many other works, of which only two are now remaining. The one is entitled *Theriaca*, describing in verse the accidents attending wounds made by venomous beasts, with the proper remedies; the other bearing the title of *Alexipharmaca*, wherein he treats poetically of poisons and their antidotes. This Nicander is not to be confounded with Nicander of Thyatira.

NICANDRA, a genus of plants belonging to the decandria class; and in the natural method ranking under the 30th order, *Contortæ*. See BOTANY *Index*.

NICARAGUA, a large river of South America, in a province of the same name, whose western extremity lies within five miles of the South sea. It is full of dreadful cataracts, and falls at length into the North sea.

NICARAGUA, a maritime province of South America, in Mexico, bounded on the north by Honduras, on the east by the North sea, on the south-east by Costa Rica, and on the south-west by the South sea; being 400 miles in length from east to west, and 120 in breadth from north to south. It is one of the most fruitful and agreeable provinces in Mexico, and is well watered with lakes and rivers. The air is wholesome and temperate; and the country produces plenty of sugar, cochineal, and fine chocolate. One of the lakes is 200 miles in circumference, has an island in the middle, and, as some say, has a tide. Leon de Nicaragua is the capital town.

NICARIA, an island of the Archipelago, between Samos and Tine, about 50 miles in circumference. A chain of high mountains runs through the middle, covered with wood, and supplies the country with springs. The inhabitants are very poor, and of the Greek communion. The productions of the island are wheat, a good deal of barley, figs, honey, and wax.

NICASTRO, an episcopal town of Italy, in the kingdom of Naples, and in the Farther Calabria; 16 miles south of Cosenza. E. Long. 16. 21. N. Lat. 39. 15.

NICE, an ancient, handsome, and considerable town on the confines of France and Italy, and capital of a county of the same name, with a strong citadel, a bishop's see. It had formerly a senate, and was a kind of a democracy. It was united to France during the late revolution, but was disjoined from it in 1814, and is now included in the dominions of Sardinia. It is very agreeably situated, four miles from the mouth of the river Var, 83 miles S. by W. of Turin. E. Long. 6. 22. N. Lat. 43. 42.

NICE, a province formerly belonging to the duke of Savoy, but now annexed to France. The inhabitants supply Genoa with timber for building ships; and carry on a trade in linen cloth, paper, oil, wine, and honey. —" Although the county of Nice be on this side of the mountains, geographers have always considered it as a province of Italy, since they have given to this beautiful part of Italy the river Var for a western limit, which is also the boundary of the county, and flows into the sea at a league distance from the capital. This province is partly covered by the maritime Alps; and is bordered on the east by Piedmont, and the states of Genoa; on the south by the Mediterranean; on the west by the Var; and on the north by Dauphiny. Its length is about 20 leagues of the country, which make about 36 English miles; its breadth is 10 leagues; and its population is about 120,000 souls.

Historical and Picturesque Description of the County of Nice.

" The city of Nice is the capital, and the seat of the bishopric, and government. It has become, within these few years, a delightful abode, by the number of strangers who assemble there in the winter, either to re-establish their health, or to enjoy the mildness of the climate, and the beauty of the country, where an unceasing verdure presents eternal spring.

" The town is situated on the sea shore, and is backed by a rock entirely insulated, on which was formerly a castle, much esteemed for its position; but it was destroyed in the year 1706 by Marechal Berwick, the garrison being too thin to defend the extent of the works. There is a distinction between the old and the new town; this last is regular, the houses are well built, and the streets are wide. Its position is by the side of the sea, and it is terminated, on one side, by a charming terrace, which serves for a promenade.

" Any person may live peaceably in this province, without fear of being troubled on points of faith, provided he conducts himself with decorum. The town has three suburbs. 1st, That of St John, which conducts to Cimier, about three leagues north from Nice, &c. The promenades this way are very delightful, and may be enjoyed in a carriage. 2d, That of the Poudriere. 3d, 3d, That of the *Croix de Marbre*, or Marble Cross. This suburb is new; and the English almost all lodge in it, being very near the town. The houses are commodious, facing on one side the great road which leads to France, and on the other a fine garden, with a prospect of the sea. All the houses are separate from each other: the company hire them for the season, i. e. from October till May. Apartments may be had from 15 to 250 louis. The proprietors commonly furnish linen, plate, &c. There are also in the town very large and commodious houses; as well as the new road, which is opened from the town to the port, by cutting that part of the rock which inclined toward the sea. The situation is delightful, and warmest in winter, being entirely covered from the north wind, and quite open to the south.

"The company is brilliant at Nice, and the amusements of the Carnival are, in proportion to the size of the town, as lively as in any of the great ones in France. There is always an Italian opera, a concert and masked ball, alternately; and the company play rather high.

"It is impossible to find a happier climate than Nice, both for summer and winter. Reaumur's thermometer, in 1781, never fell more than three degrees below the freezing point, and that only for two days; whilst at Geneva it fell ten; and in the course of the winter of 1785 it fell only two degrees; while at Geneva it fell 15. The month of May is rarely so fine in France as February at Nice. The summer is not so hot as might be expected. The thermometer never rises more than 24 degrees (86° Fahren.) above temperate in the shade; and there is always an agreeable sea breeze from ten in the morning till sunset, when the land breeze comes on. There are three chains of graduated mountains, the last of which confound their summits with the Alps; and to this triple rampart is owing the mild temperature so sensibly different from that of the neighbouring parts.

"The cultivation of the ground is as rich as can be desired. There are alternately rows of corn and beans, separated by vines attached to different fruit-trees, the almond and the fig; so that the earth being incessantly cultivated, and covered with trees, olive, orange, cedar, pomegranate, laurel, and myrtle, causes the constant appearance of spring, and forms a fine contrast with the summits of the Alps, in the back ground, covered with snow."

Nice, an ancient town of Asia, in Natolia, now called *Isnic*, with a Greek archbishop's see. It is famous for the general council assembled here in 325, which endeavoured to suppress the doctrines of Arius. It was formerly a large, populous, and well built place, and even now is not inconsiderable. See Isnic.

Nicene Creed, was composed and established, as a proper summary of the Christian faith, by the council at Nice in 325, against the Arians.—It is also called the *Constantinopolitan creed*, because it was confirmed with some few alterations, by the council of Constantinople in 381. See Creed.

NICEPHORUS, Gregoras, a Greek historian, was born about the close of the 13th century, and flourished in the 14th, under the emperors Andronicus, John Palæologus, and John Cantacuzenus. He was a great favourite of the elder Andronicus, who made him librarian of the church of Constantinople, and sent him ambassador to the prince of Servia. He accompanied this emperor in his misfortunes, and assisted at his death; after which he repaired to the court of the younger Andronicus, where he seems to have been well received; and it is certain that, by his influence over the Greeks, that church was prevailed on to refuse entering into any conference with the legates of Pope John XXII. But in the dispute which arose between Barlaam and Palamos, taking the part of the former, he maintained it zealously in the council that was held at Constantinople in 1351, for which he was cast into prison, and continued there till the return of John Palæologus, who released him; after which he held a disputation with Palamos, in the presence of that emperor. He compiled a history, which in 11 books contains all that passed from 1204, when Constantinople was taken by the French, to the death of Andronicus Palæologus the younger, in 1341.—The best edition of this work is that of the Louvre, in Greek and Latin, in 1702.

Nicephorus, *Calistus*, a Greek historian, who flourished in the 14th century under the emperor Andronicus Palæologus the elder, wrote an ecclesiastical history in 23 books; 18 of which are still extant, containing the transactions of the church from the birth of Christ to the death of the emperor Phocas in 610.—We have nothing else but the arguments of the other five books, from the commencement of the reign of the emperor Heraclius, to the end of that of Leo the Philosopher, who died in the year 911. Nicephorus dedicated his history to Andronicus Palæologus the elder. It was translated into Latin by John Langius; and has gone through several editions, the best of which is that of Paris, in 1630.

NICERON, John Francis, a French philosopher, was born at Paris in 1613. Having finished his academical studies, with a success which raised the greatest hopes of him, he entered into the order of the Minims, and took the habit in 1632; and, as is usual, he changed the names given him at his baptism for that of Francis, the name of his paternal uncle, who was also a Minim, or Franciscan. The inclination and taste which he had for mathematics appeared early. He began to apply himself to that science in his philosophical studies, and devoted to it all the time he could spare from his other employments, after he had completed his studies in theology. All the branches of the mathematics, however, did not equally engage his attention; he confined himself particularly to optics, and only learned of the rest as much as was necessary for rendering him perfect in this. There remain still, in several houses wherein he dwelt, especially at Paris, some excellent performances, which discover his skill in this way, and which make us regret that a longer life did not suffer him to carry it to that perfection which he desired; since one cannot help being surprised that he proceeded so far as he did, in the midst of those occupations and travels by which he was forced from it during the short space of time which he lived. He hath himself observed in the preface to his *Thaumaturgus Opticus*, that he went twice to Rome; and that, on his return home, he was appointed teacher of theology. He was afterwards chosen to accompany Father Francis de la Noue, vicar general of the order, in his visitation of the convents throughout all France. But the eagerness of of his passion for study put him upon making the best of all the moments he had to spare for books: and that wise economy furnished him with as much as satisfied him. Being taken sick at Aix in Provence, he died there Sept. 22. 1646, aged 33. He was an intimate acquaintance of Des Cartes. The following are his principal works: *L'Interpretation des chiffres, ou regles pour bein entendre et expliquer facilement toutes sortes des chiffres simples*, &c. 2. *La perspective curieuse, ou magie artificielle des effets merveilleux de l'optique, catoptrique, et dioptrique*. This is only an essay to the following work: 3. *Thaumaturgus opticus, sive, Admiranda opticcs, catoptrices, et dioptrices, pars prima*, &c. Two other parts were intended to complete the latter work, but were unfinished at his death.

NICERON, *John Peter*, so much celebrated on account of his Memoirs of Men illustrious in the Republic of letters, was born at Paris March 11. 1685. He was of an ancient and noble family, who were in very high repute about 1540. He studied with success in the Mazarine college at Paris, and afterwards at the college Du Plessis. In a short time, resolving to forsake the world, he consulted one of his uncles who belonged to the order of Barnabite Jesuits. This uncle examined him; and not diffident of his election, introduced him as a probationer to that society at Paris.—He was received there in 1702, took the habit in 1703, and made his vows in 1704, at the age of 19.

After he had professed himself, he was sent to Montarges, to go through a course of philosophy and theology; thence he went to Loches in Touraine to teach those sciences. He received the priesthood at Poitiers in 1708. As he was not arrived at the age to assume this order, a dispensation, which his uncommon piety had merited, was obtained in his favour. The college of Montarges having recalled him, he was their professor of rhetoric two years, and of philosophy four.—In spite of all these avocations, he was humanely attentive to every call and work of charity, and to the instruction of his fellow creatures, many of whom heard him deliver out fit rules of conduct for them, not only from the pulpits of most of the churches within the province, but even from those of Paris. In 1716, his superiors invited him to that city, that he might have an opportunity of following, with the more convenience, those studies for which he always had expressed the greatest inclination. He not only understood the ancient but the modern languages; a circumstance of infinite advantage in the composition of those works which he has given to the public, and which he carried on with great assiduity to the time of his death, which happened, after a short illness, July 8. 1738, at the age of 53. His works are, 1. *Le grand Febrifuge;* or, a Dissertation to prove that common water is the best remedy in fevers, and even in the plague; translated from the English of John Hancock minister of St Margaret's, London; in 12mo. This little treatise made its appearance, amongst other pieces relating to this subject, in 1720; and was attended with a success which carried it through three editions; the last came out in 1730, in 2 vols. 12mo, entitled, A Treatise on Common Water; Paris, printed by Cavelier. 2. The Voyages of John Ouvington to Surat, and divers parts of Asia and Africa, containing the history of the revolution in the kingdom of Golconda, and some observations upon silk worms; Paris, 1725, 2 vols. 12mo. 3. The Conversion of England to Christianity, compared with its pretended Reformation, a work translated from the English; Paris 1729, 8vo. 4. The Natural History of the Earth, translated from the English of Mr Woodward, by M. Nogues, doctor in physic; with an answer to the objections of Dr Camerarius; containing also several letters written on the same subject, and a methodical distribution of fossils, translated from the English by Niceron; Paris, 1735, 4to. 5. Memoirs of Men illustrious in the Republic of Letters, with a critical account of their works; Paris, 12mo. The first volume of this great work appeared in 1727; the others were given to the public in succession, as far as the 39th, which appeared in 1738. The 40th volume was published after the death of the author, in 1739.

NICETAS, David, a Greek historian, a native, as some relate, of Paphlagonia, who lived about the end of the 9th century. He wrote The Life of St Ignatius, patriarch of Constantinople, which was translated into Latin by Frederic Mutius bishop of Termoli: he composed also several panegyrics in honour of the apostles and other saints, which are inserted in the last continuation of the *Bibliotheca Patrum* by Combesis.

NICETAS, surnamed *Serron*, deacon of the church of Constantinople, cotemporary with Theophylact in the 11th century, and afterwards bishop of Heraclea, wrote a Catena upon the book of Job, compiled from passages of several of the fathers, which was printed at London in folio, 1637. We have also, by the same writer, several *catenæ* upon the Psalms and Canticles, Basil, 1552; together with a Commentary on the poems of Gregory Nazianzen.

NICETAS, *Arhominates*, a Greek historian of the 13th century, called *Coniates*, as being born at Chone, or Colossus, in Phrygia. He was employed in several considerable affairs at the court of Constantinople; and when that city was taken by the French in 1204, he withdrew, with a young girl taken from the enemy, to Nice in Bithynia, where he married his captive, and died in 1206. He wrote a History, or Annals, from the death of Alexius Comnenus in the year 1118, to that of Badouin in 1205; of which work we have a Latin translation by Jerome Wolfius, printed at Basil in 1557; and it has been inserted in the body of the Byzantine Historians, printed in France at the Louvre.

NICHE, in *Architecture*, a hollow sunk into a wall, for the commodious and agreeable placing of a statue. The word comes from the Italian *nechia*, "sea-shell;" in regard the statue is here enclosed in a shell, or perhaps on account of the shell wherewith the tops of some of them are adorned.

NICHOLLS, Dr Frank, physician and anatomist, was born in London in the year 1699. His father was a barrister at law; and both his parents were of good families in Cornwall. After receiving the first rudiments of his education at a private school in the country, where his docility and sweetness of temper endeared him equally to his master and his school fellows, Frank was in a few years removed to Westminster, and from thence to Oxford, where he was admitted a commoner (or sojourner) of Exeter college, under the tuition of Mr John Haviland, on March 4. 1714. There he applied himself diligently to all the usual academical studies, but particularly to natural philosophy and polite literature, of which the fruits were most conspicuous in his subsequent lectures on physiology. After reading a few books on anatomy, in order to perfect himself in the nomenclature of the animal parts then adopted, he engaged in dissections, and then devoted himself to the study of nature, perfectly free and unbiassed by the opinions of others.

On his being chosen reader of anatomy in that university, he employed his utmost attention to elevate and illustrate a science which had there been long depressed and neglected; and by quitting the beaten track of former lecturers, and minutely investigating the texture of every bowel, the nature and order of every vessel, &c. he gained a high and just reputation. He did not then reside at Oxford; but when he had finished his lectures, used to repair to London, the place of his abode, where he had determined to settle. He had once an intention of fixing in Cornwall, and for a short time practised there with great reputation; but being soon tired of the fatigues attendant on that profession in the country, he returned to London, bringing back with him a great insight, acquired by diligent observation, into the nature of the miliary fever, which was attended with the most salutary effects in his subsequent practice at London.

About this time he resolved to visit the continent, partly with a view of acquiring the knowledge of men, manners, and languages; but chiefly to acquaint himself with the opinions of foreign naturalists on his favourite study. At Paris, by conversing freely with the learned, he soon recommended himself to their notice and esteem. Winslow's was the only good system of physiology at that time known in France, and Morgagni's and Santorini's of Venice in Italy, which Dr Nicholls likewise soon after visited. On his return to England, he repeated his physiological lectures in London, which were much frequented, not only by students from both the universities, but also by many surgeons, apothecaries, and others. Soon after, his new and successful treatment of the miliary fever, then very prevalent in the southern parts of England, added much to his reputation. In 1725, at a meeting of the Royal Society, he gave his opinion on the nature of *aneurisms*, in which he dissented from Dr Freind in his History of Physic.

At the beginning of the year 1728, he was chosen a fellow of the Royal Society, to which he afterwards communicated the description of an uncommon disorder (published in the Transactions), viz. a polypus, resembling a branch of the pulmonary vein (for which Tulpius has strangely mistaken it), coughed up by an asthmatic person. He also made observations (in the same volume of the Transactions) on a treatise, by M. Helvetius of Paris, on the lungs. Towards the end of the year 1729, he took the degree of doctor of physic at Oxford. At his return to London, he underwent an examination by the president and censors of the College of Physicians, previous to his being admitted a candidate, which every practitioner must be a year before he can apply to be chosen a fellow. Dr Nicholls was chosen into the college on June 26. 1732; and two years after, being chosen Gulstonian reader of Pathology, he made the structure of the heart, and the circulation of the blood, the subject of his lectures. In 1736, at the request of the president, he again read the Gulstonian lecture; taking for his subject those parts of the human body which serve for the secretion and discharge of the urine; and the causes, symptoms, and cure of the diseases occasioned by the stone. In 1739, he delivered the anniversary Harveian oration. In 1743, he married Elizabeth, youngest daughter of the celebrated Dr Mead, by whom he had five children, two of whom died young. Two sons and a daughter survived him. In 1748, Dr Nicholls undertook the office of chirurgical lecturer, beginning with a learned and elegant dissertation on the *Anima Medica*. About this time, on the death of Dr John Cuningham, one of the elects of the college, Dr Abraham Hall was chosen to succeed him in preference to our author, who was his senior, without any apparent reason. With a just resentment, he immediately resigned the office of chirurgical lecturer, and never after attended the meetings of the fellows, except when business of the utmost importance was in agitation.

In 1751, he took some revenge in an anonymous pamphlet, entitled "The petition of the Unborn Babes to the Censors of the Royal College of Physicians of London);" in which Dr Nesbit (*Pocus*), Dr Maule (*Maulus*), Dr Barrowby (*Barebone*), principally, and Sir William Brown, Sir Edward Hulse, and the Scots incidentally, are the objects of his satire.

In 1753, on the death of Sir Hans Sloane, Bart. in his 94th year, Dr Nicholls was appointed to succeed him as one of the king's physicians, and held that office till the death of his royal master in 1760; when this most skilful physician was superseded with something like the offer of a pension, which he rejected with disdain.

The causes, &c. of the uncommon disorder of which the late king died, viz. a rupture of the right ventricle of the heart, our author explained in a letter to the earl of Macclesfield, president of the Royal Society, which was published in the Philosophical Transactions, vol. l.

In 1772, to a second edition of his treatise *De Anima Medica*, he added a dissertation *De motu cordis et sanguinis in homine nato et non nato*, inscribed to his learned friend and coadjutor the late Dr Lawrence.

Tired at length of London, and also derious of superintending the education of his son, he removed to Oxford, where he had spent most agreeably some years in his youth. But when the study of the law recalled Mr Nicholls to London, he took a house at Epsom, where he passed the remainder of his life in a literary retirement, not inattentive to natural philosophy, especially the cultivation of grain, and the improvement of barren soils, and contemplating also with admiration the internal nature of plants, as taught by Linnæus.

His constitution never was robust. In his youth, at Oxford, he was with difficulty recovered from a dangerous fever by the skill of Doctors Frampton and Frewen; and afterwards at London he had frequently been afflicted with a catarrh, and an inveterate asthmatic cough, which, returning with great violence at the beginning of the year 1778, deprived the world of this valuable man on January 7th, in the 80th year of his age.

Dr Lawrence, formerly president of the college of physicians, who gratefully ascribed all his physiological and medical knowledge to his precepts, and who, while he he lived, loved him as a brother, and revered him as a parent, two years after printed, and gave to his friends, a few copies of an elegant Latin Life of Dr Nicholls (with his head prefixed, a striking likeness, engraved by Hall from a model of Gosset, 1779; from which, through the medium of the Gentleman's Magazine, the above particulars are chiefly extracted.

NICIAS, a celebrated painter of Athens, flourished about 322 years before the Christian era; and was universally extolled for the great variety and noble choice of his subjects, the force and relievo of his figures, his skill in the distribution of the lights and shades, and his dexterity in representing all sorts of four-footed animals, beyond any master of his time. His most celebrated piece was that of Tartarus or Hell, as it is described by Homer, for which King Ptolemy the son of Lagus offered him 60 talents, or 11,250l. which he refused, and generously presented it to his own country. He was much esteemed likewise by all his cotemporaries for his excellent talent in sculpture.

NICKEL, a metallic substance; for the nature of which, see CHEMISTRY *Index*; and for an account of its ores, see MINERALOGY *Index*.

NICOBAR ISLANDS, the name of several islands in Asia, lying at the entrance of the gulf of Bengal. The largest of these islands is about 40 miles long and 15 broad, and the inhabitants are said to be a harmless sort of people, ready to supply the ships that stop there with provisions. The south end of the great Nicobar is placed in east longitude 94° 23′ 30″; and we collect from Mr Rennel's Memoir, that it is within the 12th degree of north latitude.

Of the northernmost island, which is called *Carnicobar*, we have, in the second volume of the Asiatic Researches, some interesting information respecting both the produce and natural history of the country, and the manners of its inhabitants. The author of the memoir is Mr G. Hamilton, who, in his account of this island, says, "It is low, of a round figure, about 40 miles in circumference, and appears at a distance as if entirely covered with trees: however, there are several well cleared and delightful spots upon it. The soil is a black kind of clay, and marshy. It produces in great abundance, and with little care, most of the tropical fruits, such as pine apples, plantains, papayes, cocoa-nuts, and areca-nuts; also excellent yams, and a root called *cachu*. The only four-footed animals upon the island are, hogs, dogs, large rats, and an animal of the lizard kind, but large, called by the natives *tolonqui*; these frequently carry off fowls and chickens. The only kind of poultry are hens, and those not in great plenty. There are abundance of snakes of many different kinds, and the inhabitants frequently die of their bites. The timber upon the island is of many sorts, in great plenty, and some of it remarkably large, affording excellent materials for building or repairing ships.

"The natives are low in stature, but very well made, and surprisingly active and strong; they are copper-coloured, and their features have a cast of the Malay, quite the reverse of elegant. The women in particular are extremely ugly. The men cut their hair short, and the women have their heads shaved quite bare, and wear no covering but a short petticoat, made of a sort of rush or dry grass, which reaches half way down the thigh. This grass is not interwoven, but hangs round the person something like the thatching of a house. Such of them as have received presents of cloth petticoats from the ships, commonly tie them round immediately under the arms. The men wear nothing but a narrow strip of cloth about the middle, in which they wrap up their privities so tight that there hardly is any appearance of them. The ears of both sexes are pierced when young; and by squeezing into the holes large plugs of wood, or hanging heavy weights of shells, they contrive to render them wide, and disagreeable to look at. They are naturally disposed to be good humoured and gay, and are very fond of sitting at table with Europeans, where they eat every thing that is set before them; and they eat most enormously. They do not care much for wine, but will drink bumpers of *arack* as long as they can see. A great part of their time is spent in feasting and dancing. When a feast is held at any village, every one that chooses goes uninvited, for they are utter strangers to ceremony. At those feasts they eat immense quantities of pork, which is their favourite food. Their hogs are remarkably fat, being fed upon the cocoa-nut kernel and sea water; indeed all their domestic animals, fowls, dogs, &c. are fed upon the same. They have likewise plenty of small sea fish, which they strike very dexterously with lances, wading into the sea about knee deep. They are sure of killing a very small fish at 10 or 12 yards distance. They eat the pork almost raw, giving it only a hasty grill over a quick fire. They roast a fowl, by running a piece of wood through it, by way of spit, and holding it over a brisk fire until the feathers are burnt off, when it is ready for eating, in their taste. They never drink water; only cocoa-nut milk, and a liquor called *soura* which oozes from the cocoa-nut tree after cutting off the young sprouts or flowers. This they suffer to ferment before it be used, and then it is intoxicating; to which quality they add much by their method of drinking it, by sucking it slowly through a small straw. After eating, the young men and women, who are fancifully dressed with leaves, go to dancing, and the old people surround them smoking tobacco and drinking *soura*. The dancers, while performing, sing some of their tunes, which are far from wanting harmony, and to which they keep exact time. Of musical instruments they have only one kind, and that the simplest. It is a hollow bamboo about two feet and a half long and three inches in diameter, along the outside of which there is stretched from end to end a single string made of the threads of a split cane, and the place under the string is hollowed a little to prevent it from touching. This instrument is played upon in the same manner as a guitar. It is capable of producing but few notes; the performer, however, makes it speak harmoniously, and generally accompanies it with the voice.

"Their houses are generally built upon the beach, in villages of 15 or 20 houses each; and each house contains a family of 20 persons and upwards. These habitations are raised upon wooden pillars about 10 feet from the ground; they are round, and, having no windows, are like bee-hives, covered with thatch. The entry is through a trap door below, where the family mount by a ladder, which is drawn up at night. This manner of building is intended to secure the houses from being infested with snakes and rats; and for that purpose the pillars are bound round with a smooth kind of leaf, Nicobar.

leaf, which prevents animals from being able to mount: besides which, each pillar has a broad round flat piece of wood near the top of it, the projecting of which effectually prevents the further progress of such vermine as may have passed the leaf. The flooring is made with thin strips of bamboos, laid at such distances from one another as to leave free admission for light and air; and the inside is neatly finished and decorated with fishing lances, nets, &c.

"The art of making cloth of any kind is quite unknown to the inhabitants of this island; what they have is got from the ships that come to trade in cocoanuts.

"They purchase a much larger quantity of cloth than is consumed upon their own island. This is intended for the Choury market. Choury is a small island to the southward of theirs, to which a large fleet of their boats sails every year about the month of November, to exchange cloth for canoes; for they cannot make these themselves. This voyage they perform by the help of the sun and stars, for they know nothing of the compass.

"In their disposition there are two remarkable qualities. One is their entire neglect of compliment and ceremony; and the other, their aversion to dishonesty. A Carnicobarian travelling to a distant village, upon business or amusement, passes through many towns in his way without speaking to any one; if he is hungry or tired, he goes into the nearest house, and helps himself to what he wants, and sits till he is rested, without taking the smallest notice of any of the family unless he has business or news to communicate. Theft or robbery is so very rare amongst them, that a man going out of his house never takes away his ladder or shuts his door, but leaves it open for any body to enter that pleases without the least apprehension of having any thing stolen from him.

"Their intercourse with strangers is so frequent, that they have acquired in general the barbarous Portuguese so common over India; their own language has a sound quite different from most others, their words being pronounced with a kind of stop, or catch in the throat, at every syllable.

"They have no notion of a God, but they believe firmly in the devil, and worship him from fear. In every village there is a high pole erected with long strings of ground rattans hanging from it, which, it is said, has the virtue to keep him at a distance. When they see any signs of an approaching storm, they imagine that the devil intends them a visit, upon which many superstitious ceremonies are performed. The people of every village march round their own boundaries, and fix up at different distances small sticks split at the top, into which split they put a piece of cocoa nut, a whisp of tobacco, and the leaf of a certain plant; whether this is meant as a peace offering to the devil or a scarecrow to frighten him away, does not appear.

"When a man dies, all his live stock, cloth, hatchets, fishing lances, and in short every moveable thing he possessed, is buried with him, and his death is mourned by the whole village. In one view this is an excellent custom, seeing it prevents all disputes about the property of the deceased amongst his relations. His wife must conform to custom by having a joint cut off from one of her fingers; and if she refuses this, she must submit to have a deep notch cut in one of the pillars of her house.

"I was once present at the funeral of an old woman. When we went into the house which had belonged to the deceased, we found it full of her female relations; some of them were employed in wrapping up the corpse in leaves and cloth, and others tearing to pieces all the cloth which had belonged to her. In another house hard by, the men of the village, with a great many others from the neighbouring towns, were sitting drinking *soura* and smoking tobacco. In the mean time two stout young fellows were busy digging a grave in the sand near the house. When the women had done with the corpse, they set up a most hideous howl, upon which the people began to assemble round the grave, and four men went up into the house to bring down the body; in doing this they were much interrupted by a young man, son to the deceased, who endeavoured with all his might to prevent them; but finding it in vain, he clung round the body, and was carried to the grave along with it: there, after a violent struggle, he was turned away and conducted back to the house. The corpse being now put into the grave, and the lashings which bound the legs and arms cut, all the live stock which had been the property of the deceased, consisting of about half a dozen hogs, and as many fowls, was killed and flung in above it; a man then approached with a bunch of leaves stuck upon the end of a pole, which he swept two or three times gently along the corpse, and then the grave was filled up. During the ceremony, the women continued to make the most horrible vocal concert imaginable: the men said nothing. A few days afterwards, a kind of monument was erected over the grave, with a pole upon it, to which long strips of cloth of different colours were hung.

"Polygamy is not known among them; and their punishment of adultery is not less severe than effectual. They cut, from the man's offending member, a piece of the foreskin proportioned to the frequent commission or enormity of the crime.

"There seems to subsist among them a perfect equality. A few persons, from their age, have a little more respect paid to them; but there is no appearance of authority one over another. Their society seems bound rather by mutual obligations continually conferred and received; the simplest and best of all ties."

It is our wish to take all opportunities of laying before our readers every authentic fact which can throw light upon the philosophy of the human mind. In this narrative of Mr Hamilton's respecting the natives of Carnicobar, there is however one circumstance at which we stumble. It is known to the learned, that the philosophers of Greece and Rome, as well as the magi of Persia, admitted two self-existent beings, a good and an evil (see POLYTHEISM); but we never before read of any people who had no notion of a God, and yet firmly believed in the devil. We could give instances of men worshipping the evil principle from fear, and neglecting the worship of the benevolent principle from a persuasion that he would do them all the good in his power without being bribed by sacrifices

crifices and oblations; but this is the only instance of which we have ever heard, of a people, under the influence of religion, who had *no notion of a God!* As good is at least as apparent in the world as evil, it appears to us so very unnatural to admit an *evil* and deny a *good* principle, that we cannot help thinking that Mr Hamilton, from his ignorance of the language of Carnicobar, (which he acknowledges to be different from most others), has not a perfect acquaintance with the religious creed of the natives: and that they believe in a good as well as in an evil principle, though they worship only the latter, from a persuasion, that to adore the former could be of no advantage either to him or to themselves.

Nancowry or Soury, and Comerty, two other of the Nicobar islands, are said to be the best peopled, containing not less than 800 inhabitants. Between these islands there is a safe and spacious harbour. On the north point of Nancowry, within the harbour, the Danes have long retained a small settlement, protected by a sergeant and a few soldiers and slaves.

NICODEMUS, a disciple of Jesus Christ, a Jew by nation, and by sect a Pharisee (John iii. 1. &c.) The Scripture calls him a ruler of the Jews, and our Saviour gives him the name of a master of Israel. When our Saviour began to manifest himself by his miracles at Jerusalem, at the first passover that he celebrated there after his baptism, Nicodemus made no doubt but that he was the Messiah, and came to him by night, that he might learn of him the way of salvation. Jesus told him, that no one could see the kingdom of heaven except he should be born again. Nicodemus taking this in the literal sense, made answer, "How can a man that is old be born again? Can he enter the second time into his mother's womb?" To which Jesus replied, "If a man be not born of water and of the spirit, he cannot enter into the kingdom of God. That which is born of the flesh is flesh, and that which is born of the spirit is spirit." Nicodemus asks him, "How can these things be?" Jesus answered, "Are you a master of Israel, and are you ignorant of these things? We tell you what we know, and you receive not our testimony. If you believe not common things, and which may be called earthly, how will you believe me if I speak to you of heavenly things? Nobody has ascended into heaven but the Son of God, who came down from thence. And just as Moses lifted up the brazen serpent in the wilderness, so must the Son of Man be lifted up on high. For God so loved the world that he has given his only Son, so that no man who believes in him shall perish, but shall have eternal life."

After this conversation Nicodemus became a disciple of Jesus Christ; and there is no doubt to be made, but he came to hear him as often as our Saviour came to Jerusalem. It happened on a time, that the priests and Pharisees had sent officers to seize Jesus (John vii. 45, &c.), who returning to them, made their report, that never man spoke as he did; to which the Pharisees replied, "Are you also of his disciples? Is there any one of the elders or Pharisees that have believed in him?" Then Nicodemus thought himself obliged to make answer, saying, "Does the law permit us to condemn any one before he is heard?" To which they replied, "Are you also a Galilean? Read the Scriptures, and you will find that never any prophet came out of Galilee." After this the council was dismissed. At last Nicodemus declared himself openly a disciple of Jesus Christ (*Id.* xix. 39, 40.), when he came with Joseph of Arimathea to pay the last duties to the body of Christ, which they took down from the cross, embalmed, and laid in a sepulchre.

We are told, that Nicodemus received baptism from the disciples of Christ; but it is not mentioned whether before or after the passion of our Lord. It is added, that the Jews being informed of this, deposed him from his dignity of senator, excommunicated him, and drove him from Jerusalem: but that Gamaliel, who was his cousin-german, took him to his country house, and maintained him there till his death, when he had him buried honourably near St Stephen. There is still extant an apocryphal gospel under the name of Nicodemus, which in some manuscripts bears the title of the *Acts of Pilate*.

NICOLAITANS, in church history, Christian heretics, who assumed this name from Nicholas of Antioch; who, being a Gentile by birth, first embraced Judaism and then Christianity; when his zeal and devotion recommended him to the church of Jerusalem, by whom he was chosen one of the first deacons. Many of the primitive writers believe that Nicholas was rather the occasion than the author of the infamous practices of those who assumed his name, who were expressly condemned by the Spirit of God himself, Rev. ii. 6. And indeed their opinions and actions were highly extravagant and criminal. They allowed a community of wives, and made no distinction between ordinary meats and those offered to idols. According to Eusebius, they subsisted but a short time; but Tertullian says that they only changed their name, and that their heresies passed into the sect of the Cainites.

NICOLAS, St, an island of the Atlantic ocean, and one of the most considerable of those of Cape Verd, lying between Santa Lucia and St Jago. It is of a triangular figure, and about 75 miles in length. The land is stony, mountainous, and barren; there are a great many goats in a valley inhabited by the Portuguese. W. Long. 33. 35. N. Lat. 17. 0.

NICOLO, St, the most considerable, strongest, and best peopled of the isles of Tremeti in the gulf of Venice, to the east of St Domino, and to the south of Capparata. It has a harbour defended by several towers; and a fortress, in which is an abbey, with a very handsome church. E. Long. 15. 37. N. Lat. 42. 10.

NICOMEDES, the name of several kings of the ancient Bithynia. See BITHYNIA.

NICODEMES I. had no sooner taken possession of his father's throne, before Christ 270, than, according to the custom which has in all ages been too prevalent among the despots of the east, he caused two of his brothers to be put to death. The youngest, Zibœas, having saved himself by timely flight, seized on the coast of Bithynia, which was then known by the names of *Thracia Thyniccia*, and *Thracia Asiatica*, and there maintained a long war with his brother. Nicomedes being informed that Antiochus Soter, king of Syria, was making great preparations to attack him at the same time, called in the Gauls to his assistance; and on this occasion that people first passed into Asia.—Nicomedes having with their assistance repulsed Antiochus,

chus, overcome his brother, and acquired the possession of all his father's dominions, bestowed upon them that part of Asia Minor which from them was called *Gallo-Græcia*, and Gallatia. Having now no enemies to contend with, he applied himself to the enlarging and adorning of the city of Astacus, which he called after his own name *Nicomedia*. He had two wives, and by one of them he was persuaded to leave his kingdom to her son, in preference to his elder brothers; but when or how he died is not certainly known.

NICOMEDES II. the grandson of the former, began his reign like him, by sacrificing his brothers to his jealousy, after having waded to the throne in the blood of Prusias his father. He assumed the name of *Epiphanes*, or "the Illustrious," though he performed nothing worthy of this title, or even of notice, during the whole time of his long reign. He was succeeded by his son——

NICOMEDES III. surnamed, by antiphrasis, *Philopater*, because he had murdered his father to get possession of his crown. This monarch having entered into alliance with Mithridates the Great king of Pontus, invaded Paphlagonia; and having seized on that country, he attempted likewise to make himself master of Cappadocia. This country, however, was at that time subject to his powerful ally; who thereupon marching into Bithynia at the head of an army, drove Nicomedes from the throne, and raised his brother Socrates to it in his room. The dethroned prince had recourse to the Romans, who expelled the usurper, and restored him to his hereditary dominions. For this favour they pressed him, and at length prevailed upon him, contrary to his own inclination, and the opinion of his friends, to make inroads into the territories of Mithridates, with whom Rome wanted a subject of dispute. The king of Pontus bore for some time the devastations committed by Nicomedes with great patience, that he might not seem to be the aggressor; but at last he routed his army on the banks of the Amnius, drove him a second time from his dominions, and obliged him to seek for shelter in Paphlagonia, where he led a private life till the time of Sylla, who replaced him on the throne. He was succeeded by his son——

NICOMEDES IV. who performed nothing which the many writers who flourished in his time have thought worth transmitting to posterity. As he died without issue male, he left his kingdom by his last will to the Romans, who reduced it to the form of a province. Sallust, disagreeing with the ancients, tells us, that Nicomedes left a son named *Musa* or *Mysa*; and introduces Mithridates as complaining of the Romans to Arsaces king of Parthia, for seizing on the kingdom of Bithynia, and excluding the son of a prince who had on all occasions shown himself a steady friend to their republic. But this Musa was the daughter and not the son of Nicomedes, as we are told in express terms by Suetonius, Velleius Paterculus, and Appian. All we know of her is, that upon the death of her father she claimed the kingdom of Bithynia for her son, as the next male heir to the crown, but without success; no motives of justice being of such weight with the ambitious Romans as to make them part with a kingdom.

NICOMEDIA, in *Ancient Geography*, a metropolis of Bithynia, built by Nicomedes the grandfather of Prusias. It is situated on a point of the Sinus Astacenus, (Pliny); surnamed the *Beautiful*, (Athenæus): the largest city of Bithynia, (Pausanias), who says it was formerly called *Astacus;* though Pliny distinguishes Astacum and Nicomedia as different cities. Nicomedia was very famous, not only under its own kings, but under the Romans: it was the royal residence of Dioclesian, and of Constantine while Constantinople was building, if we may credit Nicephorus. It is still called *Nicomedia*, at the bottom of a bay of the Propontis in the Hither Asia. E. Long. 30. 0. N. Lat. 41. 20. It is a place of consequence; carries on a trade in silk, cotton, glass, and earthen ware, and is the see of a Greek archbishop.

NICOMEDUS, a geometrician, famous on account of the invention of the curve called *conchoid*, which is equally useful in resolving the two problems of doubling the cube and trisecting the angle. It appears that he lived soon after Eratosthenes, for he rallied that philosopher on the mechanism of his mesolabe. Geminus, who lived in the second century before Jesus Christ, has written on the conchoid, though Nicomedus was always esteemed the inventor of it. Those who place him four or five centuries after Jesus Christ must be ignorant of these facts, by which we are enabled to ascertain pretty nearly the time in which he lived.

NICON, a native and patriarch of Russia, was born in 1613, in a village of the government of Nishnei Novogorod, of such obscure parents, that their names and station are not transmitted to posterity. He received at the baptismal font the name of *Nikita*, which afterwards, when he became monk, he changed to *Nicon*, the appellation by which he is more generally known. He was educated in the convent of St Macarius, under the care of a monk. From the course of his studies, which were almost solely directed to the Holy Scriptures, and the exhortations of his preceptor, he imbibed at a very early period the strongest attachment to a monastic life; and was only prevented from following the bent of his mind by the persuasions and authority of his father. In conformity, however, to the wishes of his family, though contrary to his own inclination, he entered into matrimony; and, as that state precluded him from being admitted into a convent, he was ordained a secular priest. With his wife he continued ten years, partly in the country, and partly at Moscow, officiating as a parish priest. The loss of three children, however, gave him a total disgust to the world: in consequence of which, his wife was persuaded to take the veil, and he became a monk; his retreat was in an island of the White sea, and a kind of ecclesiastical establishment was formed, as remarkable for the austerities of its rules as the situation was for its solitude. There were about 12 monks, but they all lived in different cells. Such a system, combined with the most gloomy ideas, occasioned so much cloistered pride as tarnished his character, when he was afterwards called up to fulfil the duties of a public and exalted station. Our limits do not permit us to be minute in our account of his life, we must therefore be contented with barely reciting general facts. Within less than the space of five years, Nicon was successively

successively created archimandrite, or abbot of the Novospatskoi convent, archbishop of Novogorod, and patriarch of Russia. That he was worthy of these rapid promotions, few will doubt who are acquainted with his character; for he was possessed of very extraordinary qualities, such as even his enemies allow and admire. His courage was undaunted, his morals irreproachable, his charity extensive and exalted, his learning deep and comprehensive, and his eloquence commanding. When archbishop, he obtained the respect of the inhabitants by his unwearied assiduity in the discharge of his trust; and conciliated their affections by acts of unbounded charity: Nor was he less conspicuous in the discharge of the office of patriarch, to which dignity he was appointed in 1652, in the 39th year of his age.

Nor was he only distinguished in his own profession, for he shone even as a statesman. At length, however, he fell a victim to popular discontents; which misfortune, though he was far from deserving it, was certainly the effect of imprudence. He abdicated the office of patriarch, which would otherwise have been taken from him, in July 1658, and bore his reverse of fortune with heroic magnanimity: he returned to a cell, and commenced his former austerities. His innocence, however, could not protect him from further malice: his enemies obtained him to be formally deposed in 1666. This degradation was followed by imprisonment, which was for some time very rigorous, because he, conscious of his own innocence, refused to accept pardon for crimes of which he was not guilty. In 1676, however, he was removed to the convent of St Cyril, and enjoyed perfect liberty.

Nicon survived his deposition 15 years. In 1681, he requested and obtained permission to return to the convent of Jerusalem, that he might end his days in that favourite spot; but he expired upon the road near Yaroslaf, in the 66th year of his age. His remains were transported to that convent, and buried with all the ceremonies used at the interment of patriarchs.

NICOPOLI, a town of Turkey in Europe, and in Bulgaria, famous for being the place where the first battle was fought between the Turks and Christians in 1396; and where the latter were defeated with the loss of 20,000 men. E. Long. 25. 33. N. Lat. 43. 46.

NICOSIA, the capital of the island of Cyprus, where a Turkish bashaw resides. It is delightfully situated between the mountains of Olympus and a chain of others, and was formerly well fortified by the Venetians; but the works are now in ruins. It was once nine miles in circumference, but was reduced to three by the Venetians. There are plantations of olives, almonds, lemons, oranges, mulberries, and cypress trees, interspersed among the houses, which give the town a delightful appearance. The church of Sancta Sophia is an old Gothic structure, which the Turks have turned into a mosque, and destroyed the ornaments. It is 100 miles west of Tripoli, and 160 south-west of Aleppo. E. Long. 34. 45. N. Lat. 34. 54.

NICOT, John, lord of Villemain, and master of request of the French king's household, was born at Nismes, and was sent ambassador to Portugal in 1559; whence he brought the plant which, from his name,

was called *Nicotiana*, but is now more generally known by the name of *Tobacco*. He died at Paris in 1603. He wrote a French and Latin dictionary in folio; a treatise on navigation; and other works.

NICOTIANA, Tobacco, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 28th order, *Luridæ*. See Botany *Index*.—There are seven species, of which the most remarkable is the *tabacum*, or common tobacco plant. This was first discovered in America by the Spaniards about the year 1560, and by them imported into Europe. It had been used by the inhabitants of America long before; and was called by those of the islands *yoli*, and *petun* by the inhabitants of the continent. It was sent into Spain from Tabaco, a province of Yucatan, where it was first discovered, and from whence it takes its common name. Sir Walter Raleigh, it is generally said, first introduced it into England about the year 1585, and taught his countrymen how to use it. Dr Cotton Mather, however, (in his Christian Philosopher) says, that in the above year one Mr Lane carried over some of it from Virginia, which was the first time it had ever been seen in Europe. Tobacco is commonly used among the oriental nations, though it is uncertain by whom it was introduced among them. Considerable quantities of it are cultivated in the Levant, on the coasts of Greece and the Archipelago, in Italy, and in the island of Malta.

There are two varieties of that species of nicotiana which is cultivated for common use, and which are distinguished by the names of *Oronokoe*, and *sweet-scented tobacco*. They differ from each other only in the figure of their leaves; those of the former being longer and narrower than the latter. They are tall herbaceous plants, growing erect with fine foliage, and rising with a strong stem from six to nine feet high. The stalk near the root is upward of an inch diameter, and surrounded with a kind of hairy or velvet clammy substance, of a yellowish green colour. The leaves are rather of a deeper green, and grow alternately at the distance of two or three inches from each other. They are oblong, of a spear-shaped oval, and simple; the largest about 20 inches long, but decreasing in size as they ascend, till they come to be only 10 inches long, and about half as broad. The face of the leaves is much corrugated, like those of spinage when full ripe. Before they come to maturity, when they are about five or six inches long, the leaves are generally of a full green, and rather smooth; but as they increase in size, they become rougher, and acquire a yellowish cast. The stem and branches are terminated by large bunches of flowers collected into clusters, of a delicate red; the edges, when full blown, inclining to a pale purple. They continue in succession till the end of the summer; when they are succeeded by seeds of a brown colour, and kidney-shaped. These are very small, each capsule containing about 1000; and the whole produce of a single plant is reckoned at about 350,000. The seeds ripen in the month of September.

Mr Carver informs us, that the Oronokoe, or, as it is called, the *long Virginian tobacco*, is the kind best suited for bearing the rigour of a northern climate, the strength as well as the scent of the leaves being greater than that of the other. The *sweet-scented* sort flourishes most in a sandy soil, and in a warm climate, where

Nicotiana. where it greatly exceeds the former in the celerity of its growth; and is likewise, as its name intimates, much more mild and pleasant.

Culture.—Tobacco thrives best in a warm, kindly, rich soil, that is not subject to be overrun by weeds. In Virginia, the soil in which it thrives best is warm, light, and inclining to be sandy; and therefore, if the plant is to be cultivated in Britain, it ought to be planted in a soil as nearly of the same kind as possible. Other kinds of soil might probably be brought to suit it, by a mixture of proper manure; but we must remember, that whatever manure is made use of, must be thoroughly incorporated with the soil. The best situation for a tobacco plantation is the southern declivity of a hill, rather gradual than abrupt, or a spot that is sheltered from the north winds: but at the same time it is necessary that the plants enjoy a free air; for without that they will not prosper.

As tobacco is an annual plant, those who intend to cultivate it ought to be as careful as possible in the choice of the seeds; in which, however, with all their care, they may be sometimes deceived. The seeds are to be sown about the middle of April, or rather sooner in a forward season, in a bed prepared for this purpose of such soil as has been already described, mixed with some warm rich manure. In a cold spring, hot beds are most eligible for this purpose, and gardeners imagine that they are always necessary: but Mr Carver tells us, that he is convinced, when the weather is not very severe, the tobacco seeds may be raised without doors; and for this purpose gives us the following directions.

Treatise on the Culture of Tobacco.

"Having sown the seed in the manner above directed, on the least apprehension of a frost after the plants appear, it will be necessary to spread mats over the beds, a little elevated from the ground by poles laid across, that they may not be crushed. These, however, must be removed in the morning, soon after the sun appears, that they may receive as much benefit as possible from its warmth and from the air. In this manner proceed till the leaves have attained about two inches in length and one in breadth; which they will do in about a month after they are sown, or near the middle of May, when the frosts are usually at an end. One invariable rule for their being able to bear removal is, when the fourth leaf is sprouted, and the fifth just appears. Then take the opportunity of the first rains or gentle showers to transplant them into such a soil and situation as before described; which must be done in the following manner.—The land must be ploughed, or dug up with spades, and made as mellow and light as possible. When the plants are to be placed, raise with the hoe small hillocks at the distance of two feet or a little more from each other, taking care that no hard sods or lumps are in it; and then just indent the middle of each, without drilling holes, as for some other plants.

"When your ground is thus prepared, dig in a gentle manner from their native bed such plants as have attained the proper growth for transplanting above mentioned; and drop, as you pass, one on every hillock. Insert a plant gently into each centre, pressing the soil around gently with your fingers; and taking the greatest care, during the operation, that you do not break off any of the leaves, which are at this time exquisitely tender. If the weather proves dry after they are thus transplanted, they must be watered with soft water, in the same manner as is usually done to coleworts, or plants of a similar kind. But though you now seem to have a sufficient quantity of plants for the space you intend to cultivate, it is yet necessary that you continue to attend to your bed of seedlings, that you may have enough to supply any deficiencies which through accident may arise. From this time great care must be taken to keep the ground soft and free from weeds, by often stirring with your hoe the mould round the roots; and to prune off the dead leaves that sometimes are found near the bottom of the stalk.

"The difference of this climate from that in which I have been accustomed to observe the progress of this plant, will not permit me to direct with certainty the time which is most proper to take off the top of it, to prevent it from running to seed. This knowledge can only be acquired by experience. When it has risen to the height of more than two feet, it commonly begins to put forth the branches on which the flowers and seeds are produced; but as this expansion, if suffered to take place, would drain the nutriment from the leaves, which are the most valuable part, and thereby lessen their size and efficacy, it becomes needful at this stage to nip off the extremity of the stalk to prevent its growing higher. In some other climates, the top is commonly cut off when the plant has 15 leaves; but if the tobacco is intended to be a little stronger than usual, this is done when it has only 13; and sometimes, when it is designed to be remarkably powerful, 11 or 12 are only allowed to expand. On the contrary, if the planter is desirous of having his crop very mild, he suffers it to put forth 18 or 20: but in this calculation, the three or four lower leaves next the ground, which do not grow so large and fine as the others, are not to be reckoned.

"This operation, denominated *topping* the tobacco, is much better performed by the finger and thumb than with any instrument; because the grasp of the fingers closes the pores of the plant; whereas, when it is done by instruments, the juices are in some degree exhausted. Care must also be taken to nip off the sprouts that will be continually springing up at the junction of the leaves with the stalks. This is termed *succouring*, or *suckering*, the tobacco; and ought to be repeated as often as occasion requires.

"As it is impossible to ascertain the due time for topping the plant, so it is equally impossible, without experiment, to ascertain the time it will take to ripen in this country. The apparent signs of its maturity are these: The leaves, as they approach a state of ripeness, become more corrugated or rough; and when fully ripe, appear mottled with yellowish spots on the raised parts; whilst the cavities retain their usual green colour. They are at this time also thicker than they have been before; and are covered with a downy velvet, like that formerly mentioned, on the stalks. If heavy rains happen at this critical period, they will wash off this excrescent substance, and thereby damage the plants. In this case, if the frosty nights are not begun, it is proper to let them stand a few days longer; when, if the weather be moderate, they will recover this substance again. But if a frost unexpectedly happens during

Nicotiana.

ring the night, they must be carefully examined in the morning, before the sun has any influence upon them; and those which are found to be covered with frosty particles, whether thoroughly ripe or not, must be cut up; for though they may not all appear to be arrived at a state of maturity, yet they cannot be far from it, and will differ but little in goodness from those that are perfectly so."

Tobacco is subject to be destroyed by a worm; and without proper care to exterminate this enemy, a whole field of plants may soon be lost. This animal is of the horned species, and appears to be peculiar to the tobacco plant; so that in many parts of America it is distinguished by the name of the *tobacco worm*. In what manner it is first produced, or how propagated, is unknown: but it is not discernible till the plants have attained about half their height; and then appears to be nearly as large as a gnat. Soon after this it lengthens into a worm; and by degrees increases in magnitude to the bigness of a man's finger. In shape it is regular from its head to its tail, without any diminution at either extremity. It is indented or ribbed round at equal distances, nearly a quarter of an inch from each other; and having at every one of these divisions a pair of feet or claws, by which it fastens itself to the plant. Its mouth, like that of the caterpillar, is placed under the fore part of the head. On the top of the head, between the eyes, grows a horn about half an inch long, and greatly resembling a thorn; the extreme part of which is of a brown colour, a firm texture, and the extremity sharp pointed. It is easily crushed; being only, to appearance, a collection of green juice enclosed in a membranaceous covering, without the internal parts of an animated being. The colour of its skin is in general green, interspersed with several spots of a yellowish white; and the whole covered with a short hair scarcely to be discerned. These worms are found the most predominant during the latter end of July and the beginning of August; at which time the plants must be particularly attended to, and every leaf carefully searched. As soon as a wound is discovered, and it will not be long before it is perceptible, care must be taken to destroy the cause of it, which will be found near it, and from its unsubstantial texture may easily be crushed: but the best method is to pull it away by the horn, and then crush it.

When the tobacco is fit for being gathered, as will appear from an attention to the foregoing directions, on the first morning that promises a fair day, before the sun is risen, take an axe or a long knife, and holding the stalk near the top with one hand, sever it from its root with the other, as low as possible. Lay it gently on the ground, taking care not to break off the leaves, and there let it remain exposed to the rays of the sun throughout the day, or until the leaves, according to the American expression, are entirely *wilted:* that is, till they become limber, and will bend any way without breaking. But if the weather should prove rainy without any intervals of sunshine, and the plants appear to be fully ripe, they must be housed immediately. This must be done, however, with great care, that the leaves, which are in this state very brittle, may not be broken. They are next to be placed under proper shelter, either in a barn or covered hovel, where they cannot be affected by rain or too much air, thinly scattered on the floor; and if the sun does not appear for several days, they must be left to wilt in that manner; but in this case the quality of the tobacco will not be quite so good.

When the leaves have acquired the above-mentioned flexibility, the plants must be laid in heaps, or rather in one heap if the quantity is not too great, and in about 24 hours they will be found to sweat. But during this time, when they have lain for a little while, and begin to ferment, it will be necessary to turn them; bringing those which are in the middle to the surface, and placing those which are at the surface in the middle. The longer they lie in this situation, the darker coloured is the tobacco; and this is termed *sweating* the tobacco. After they have lain in this manner for three or four days, (for a longer continuance might make the plants turn mouldy), they may be fastened together in pairs with cords or wooden pegs, near the bottom of the stalk, and hung across a pole, with the leaves suspended in the same covered place, a proper interval being left between each pair. In about a month the leaves will be thoroughly dried, and of a proper temperature to be taken down. This state may be ascertained by their appearing of the same colour with those imported from America. But this can be done only in wet weather.—The tobacco is exceedingly apt to attract the humidity of the atmosphere, which gives it a pliability that is absolutely necessary for its preservation; for if the plants are removed in a very dry season, the external parts of the leaves will crumble into dust, and a considerable waste will ensue.

Cure.—As soon as the plants are taken down, they must again be laid in a heap, and pressed with heavy logs of wood for about a week; but this climate may possibly require a longer time. While they remain in this state, it will be necessary to introduce your hand frequently into the heap, to discover whether the heat be not too intense; for in large quantities this will sometimes be the case, and considerable damage will be occasioned by it. When they are found to heat too much, that is, when the heat exceeds a moderate glowing warmth, part of the weight by which they are pressed must be taken away; and the cause being removed, the effect will cease. This is called the *second* or *last sweating;* and, when completed, which it generally will be about the time just mentioned, the leaves must be stripped from the stalks for use. Many omit this last sweating; but Mr Carver thinks that it takes away any remaining harshness, and renders the tobacco more mellow. The strength of the stalk also is diffused by it through the leaves, and the whole mass becomes equally meliorated.—When the leaves are stripped from the stalks, they are to be tied up in bunches or *hands*, and kept in a cellar or other damp place; though if not handled in dry weather but only during a rainy season, it is of little consequence in what part of the house or barn they are laid up. At this period the tobacco is thoroughly cured, and as proper for manufacturing as that imported from the colonies.

Our author advises the tobacco planter, in his first trials, not to be too avaricious, but to top his plants before they have gained their utmost height: leaving only about the middle quantity of leaves directed before to give it a tolerable degree of strength. For though this

this, if excessive, might be abated during the cure by an increase of sweating, or be remedied the next season by suffering more leaves to grow, it can never be added; and, without a certain degree of strength, the tobacco will always be tasteless and of little value. On the contrary, though it be ever so much weakened by sweating, and thereby rendered mild, yet it will never lose the aromatic flavour which accompanied that strength, and which greatly adds to its value. A square yard of land, he tells us, will rear about 500 plants, and allow proper space for their nurture till they are fit for transplanting.

The following extract, which is copied from a manuscript of Dr Barham (A), for directing the raising, cultivating, and curing tobacco in Jamaica, is perhaps worthy of the attention of those who wish to be further acquainted with this subject.

"Let the ground or woodland wherein you intend planting tobacco be well burned, as the greater the quantity of wood ashes the better. The spot you intend raising your plants on must be well strewed with ashes, laid smooth and light: then blow the seed from the palm of your hand gently on the bed, and cover it over with palm or plantain leaves.

"When your plants are about four inches high, draw them and plant them out about three feet asunder; and when they become as high as your knee, cut or pluck off the top; and if there are more than 12 leaves on the plant, take off the overplus, and leave the rest entire.

"The plant should now be daily attended to, in order to destroy the caterpillars that are liable to infest it; as also to take off every sprout or sucker that puts out at the joints, in order to throw the whole vegetable nourishment into the large leaves.

"When the edges and points of the leaves begin to turn a little yellow, cut down the stalks about ten o'clock in the morning, taking the opportunity of a fine day, and be careful the dew is fully off the plant, and do not continue this work after two in the afternoon. As fast as it is cut let it be carried into your tobacco house, which must be so close as to shut out all air, (on this much depends), and hung up on lines tied across, for the purpose of drying.

"When the stalks begin to turn brownish, take them off the lines, and put them in a large binn, and lay on them heavy weights for 12 days; then take them out, and strip off the leaves, and put them again into the binn, and let them be well pressed, and so as no air gains admission for a month. Take them out; tie them in bundles about 60 leaves in each, which are called *monococs*; and are ready for sale. But observe to let them always be kept close till you have occasion to dispose of them.

"Let your curing house be well built, and very close and warm; if a boarded building, it will not be amiss, in a wet situation, to cover the whole outside with thatch and plantain trash, to keep off the damps; for by this care you preserve the fine volatile oil in the leaves. Observe, no smoke is to be made use of or admitted into your curing house."

For an account of the medical effects of tobacco, see MATERIA MEDICA *Index*.

The most common uses of this plant, are either as a sternutatory when taken by way of snuff, as a masticatory by chewing it in the mouth, or as effluvia by smoking it; and when taken in moderation, it is not an unhealthful amusement. Before pipes were invented, it was usually smoked in segars, and they are still in use among some of the southern nations. The method of preparing these is at once simple and expeditious. A leaf of tobacco being formed into a small twisted roll, somewhat larger than the stem of a pipe, and about eight inches long, the smoke is conveyed through the winding folds which prevent it from expanding, as through a tube; so that one end of it being lighted, and the other applied to the mouth, it is in this form used without much inconvenience. But, in process of time, pipes being invented, they were found more commodious vehicles for the smoke, and are now in general use.

Among all the productions of foreign climes introduced into these kingdoms, scarce any has been held in higher estimation by persons of every rank than tobacco. In the countries of which it is a native, it is considered by the Indians as the most valuable offering that can be made to the beings they worship. They use it in all their civil and religious ceremonies. When once the spiral wreaths of its smoke ascend from the feathered pipe of peace, the compact that has been just made is considered as sacred and inviolable. Likewise, when they address their great Father, or his guardian spirits, residing, as they believe, in every extraordinary production of nature, they make liberal offerings to them of this valuable plant, not doubting but that they are thus secured of protection.

Tobacco is made up into rolls by the inhabitants of the interior parts of America, by means of a machine called a *tobacco wheel*. With this machine they spin the leaves after they are cured, into a twist of any size they think fit: and having folded it into rolls of about 20 pounds each, they lay it by for use. In this state it will keep for several years, and be continually improving, as it always grows milder. The Illinois usually form it into carrots; which is done by laying a number of leaves, when cured, on each other after the ribs have been taken out, and rolling them round with packthread, till they become cemented together. These rolls commonly measure about 18 or 20 inches in length, and nine round in the middle part.

Tobacco forms a very considerable article in commerce; for an account of which, see the articles GLASGOW and VIRGINIA.

NICTITATING MEMBRANE, a thin membrane chiefly found in the bird and fish kind, which covers the eyes of these animals, sheltering them from the dust or too much light; yet is so thin and pellucid, that they can see pretty well through it.

NIDDUI,

(A) This gentleman was cotemporary with Sir Hans Sloane. He was a man of great probity, an able physician, and a skilful naturalist. He collected and arranged a number of the plants of Jamaica, which he presented to Dr Sloane, and made several communications to the Royal Society.

NIDDUI, in the Jewish customs, is used to signify "separated or excommunicated." This, according to some, was to be understood of the lesser sort of excommunication in use among the Hebrews. He that had incurred it was to withdraw himself from his relations, at least to the distance of four cubits: it commonly continued a month. If it was not taken off in that time, it might be prolonged for 60 or even 90 days: but if, within this term, the excommunicated person did not give satisfaction, he fell into the *cherem*, which was a second sort of excommunication; and thence into the third sort, called *shammata* or *shematta*, the most terrible of all. But Selden has proved that there were only two kinds of excommunication, viz. the greater and less; and that these three terms were used indifferently.

NIDUS, among naturalists, signifies a nest or proper repository for the eggs of birds, insects, &c. where the young of these animals are hatched and nursed.

NIDIFICATION, a term generally applied to the formation of a bird's nest, and its hatching or bringing forth its young. See ORNITHOLOGY.

NIECE, a brother's or sister's daughter, which in the civil law is reckoned the third degree of consanguinity.

NIEMEN, a large river of Poland, which rises in Lithuania, where it passes by Bielica, Grodno, and Konno: it afterwards runs through part of Samogitia and Ducal Prussia, where it falls into the lake called the *Curisch-haff*, by several mouths, of which the most northern is called the *Russ*. This lake communicates with the Baltic.

NIENBURGH, a rich and strong town of Germany, in the duchy of Brunswick-Lunenburg, with a strong castle. It carries on a considerable trade in corn and wool, and is seated in a fertile soil on the river Weser. E. Long. 9. 26. N. Lat. 52. 44.

NIEPER, or DNIEPER, a large river of Europe, and one of the most considerable of the north, formerly called the Boristhenes. Its source is in the middle of Muscovy, running west by Smolensko, as far as Orsa; and then turns south, passing by Mohilow, Bohaczo, Kiow, Czyrkassy, the fortress of Kudak, Dessau, and Oczakow, falling into the Black sea; as also in its course it divides Little Tartary from Budziac Tartary.

NIESS, a mountain in the environs of Berne in Switzerland. It is the last mountain in a high chain of calcareous hills, of which the Stockhorn, the Neuneren, and the Ganterish, have been illustrated by the botanical labours of the celebrated Haller. Niess stands on the borders of the lake Thun, and separates the valley of Frutingen from that of Simme. It is very interesting to the curious traveller, on account of the fine view from its top; and to naturalists, because it joins the Alps. Towards its foot, beds of slate have been discovered: it is of calcareous stone higher up; and near its top is found a species of pudding-stone, filled with small fragments of broken petrifactions.

NIESTER, a large river of Poland, which has its source in the lake Niester, in the palatinate of Lemburg, where it passes by Halicz. Then it separates Podolia and Oczakow Tartary from Moldavia and Budziac Tartary; and falls into the Black sea at Belgorod, between the mouths of the Nieper and the Danube.

NIGELLA, FENNEL-FLOWER, or *Devil in a Bush*, a genus of plants, belonging to the pentandria class. See BOTANY *Index*.

NIGER, C. PESCENNIUS JUSTUS, a celebrated governor in Syria, well known by his valour in the Roman armies while in a private station. At the death of Pertinax he was declared emperor of Rome; and his claims to that elevated station were supported by a sound understanding, prudence of mind, moderation, courage, and virtue. He proposed to imitate the actions of the venerable Antoninus, of Trajan, of Titus, and M. Aurelius. He was remarkable for his fondness of ancient discipline. He never suffered his soldiers to drink wine, but obliged them when thirsty to use water and vinegar. He forbade the use of silver or gold utensils in his camp. All the bakers and cooks were driven away, and the soldiers were ordered to live during the expedition they undertook merely upon biscuits. In his punishments Niger was inexorable: he condemned ten of his soldiers to be beheaded in the presence of the army because they had stolen and eaten a fowl. The sentence was heard with groans. The army interfered; and when Niger consented to diminish the punishment, for fear of kindling rebellion, he yet ordered the criminals to make each a restoration of ten fowls to the person whose property they had stolen. They were besides ordered not to light a fire the rest of the campaign, but to live upon cold aliments and to drink nothing but water. Such great qualifications in a general seemed to promise the restoration of ancient discipline in the Roman armies; but the death of Niger frustrated every hope of reform. Severus, who had also been invested with the imperial purple, marched against him: some battles were fought, and Niger was at last defeated, A. D. 195. His head was cut off and fixed to a long spear, and carried in triumph through the streets of Rome. He reigned about a year.

NIGER, a large river of Africa, of which many erroneous opinions have been entertained. According to Herodotus, Pliny, Ptolemy, and many of the ancients, this river runs from west to east, an opinion which was long forgotten, and in more modern times it was believed to flow from east to west; but from the recent discoveries of the indefatigable Mr Park, who himself saw this majestic river, the opinion of the ancients is now fully established, that its course is from west to east. The source of the Niger is supposed to be in that mountainous region in western Africa, which gives origin to the rivers Gambia and Senegal, which discharge their waters into the Western ocean, while the Niger rising from the opposite side of the mountains, takes an easterly direction. See AFRICA, p. 264. and 272. See also AFRICA, SUPPLEMENT, p. 101.

NIGHT, that part of the natural day during which the sun is underneath the horizon; or that space wherein it is dusky.

Night was originally divided by the Hebrews and other eastern nations into three parts or watches. The Romans, and after them the Jews, divided the night into four parts or watches; the first of which began at sunset, and lasted till nine at night, according to our way of reckoning; the second lasted till mid-

night;

night; the third till three in the morning; and the fourth ended at sunrise. The ancient Gauls and Germans divided their time not by days but by nights; and the people of Iceland and the Arabs do the same at this day. The like is observed of the Anglo-Saxons.—The length and shortness of night or of darkness is according to the season of the year and position of the place; and the causes of this variety are now well known. See ASTRONOMY, &c.

NIGHT, in scripture language, is used for the times of heathenish ignorance and profaneness (Rom. xiii. 12.); for adversity and affliction (Is. xxi. 12.); and lastly, for death (John ix. 4.).

NIGHT-Angling, a method of catching large and shy fish in the night-time. Trout, and many other of the better sorts of fish, are naturally shy and fearful; they therefore prey in the night as the securest time.—The method of taking them on this plan is as follows: The tackle must be strong, and need not be so fine as for day fishing, when every thing is seen; the hook must be baited with a large earth worm, or a black snail, and thrown out into the river; there must be no lead to the line, so that the bait may not sink, but be kept drawling along, upon or near the surface. Whatever trout is near the place will be brought thither by the motion of the water, and will seize the worm or snail. The angler will be alarmed by the noise which the fish makes in rising, and must give him line, and time to swallow the hook; then a slight touch secures him. The best and largest trouts are found to bite thus in the night; and they rise mostly in the still and clear deeps, not in the swift and shallow currents. Sometimes, though there are fish about the place, they will not rise at the bait: in this case the angler must put on some lead to his line, and sink it to the bottom.

NIGHT-Mare, or *Incubus*. See MEDICINE, N° 329.

NIGHT-Walkers. See MEDICINE, N° 329, and NOCTAMBULI.

NIGHT-Walkers, in *Law*, are such persons as sleep by day and walk by night, being oftentimes pilferers or disturbers of the public peace. Constables are authorized by the common law to arrest night-walkers and suspicious persons, &c. Watchmen may also arrest night-walkers, and hold them until the morning; and it is said, that a private person may arrest any suspicious night-walker, and detain him till he give a good account of himself. One may be bound to the good behaviour for being a night-walker; and common night-walkers, or haunters of bawdy-houses, are to be indicted before justices of peace, &c. But it is not held lawful for a constable, &c. to take up any woman as a night-walker on bare suspicion only of being of ill-fame, unless she be guilty of a breach of the peace, or some unlawful act, and ought to be found misdoing.

NIGHTINGALE, a species of motacilla. See ORNITHOLOGY *Index*.

NIGHTSHADE. See SOLANUM, BOTANY *Index*.

Deadly NIGHTSHADE. See ATROPA, BOTANY *Index*.—The berries of this plant are of a malignant poisonous nature; and, being of a sweet taste, have frequently proved destructive to children. It is said, that a large glass of warm vinegar, taken as soon as possible after eating the berries, will prevent their bad effects.

NIGHT-Watching, a practice of very remote antiquity, which belongs to the oldest regulations of police. So early as the time of Solomon we find mention made of it, and likewise in the Psalms of David *. Sentinels were stationed in different places in Athens and other cities of Greece, and they were kept to their duty by the visitations of the *Thesmothetæ*. There were also *triumviri nocturni* in the city of Rome, as appears from the commentaries of Heubach on the police of the Romans. It appears, however, that the design of these institutions was rather the prevention of fires, than the guarding against alarms or dangers by night, although attention was likewise paid to these in process of time. The apprehension of fires was the pretext of Augustus, when he wished to strengthen the night-watch for suppressing nocturnal commotions.

* *Song of Solomon*, chap. iii. ver. 3. *Psal.* cxxvii. 1.

It does not appear that calling out the hours became an established practice before the erection of city gates, and probably had its rise in Germany; yet it would have been attended with advantages in ancient Rome, where there were no public clocks, nor any thing in private houses to indicate the hours. The periods for soldiers to mount guard were determined by water-clocks; at the end of each hour they blew a horn, and by means of this signal each individual might ascertain the hour of the night. It seems evident, however, that these regulations were only attended to in time of war.

In the city of Paris, night-watching was established, as at Rome, in the very commencement of its monarchy; and De la Mare quotes the ordinances of Clothaire II. upon this subject, in the year 595. The citizens at first kept watch in rotation; but this practice was afterwards set aside, and, by the payment of a certain sum of money, a permanent watch was established. In the opinion of the learned and indefatigable Beckmann, the establishment of single watchmen, to call out the hours through the streets, is peculiar to Germany, and only copied by surrounding nations in more modern times. The elector, John George, in 1588, appointed watchmen at Berlin; and Mabillon describes it as a practice peculiar to that country. Horns are made use of by watchmen in some places, and rattles in others, the former being most proper for villages, and the latter for cities.

The Chinese, so early as the ninth century, had watchmen posted on their towers, who announced the hours both by day and night, by striking forcibly on a suspended board, which in that country is said to be in use to the present period; and at Petersburgh, in Russia, the watchmen employ a suspended plate of iron for a similar purpose. In this manner also Christians are assembled together in the Levant, for the purpose of attending divine service; and monks were thus awakened in monasteries at the most early periods, to attend to the proper hours of prayer.

We find mention made of steeple-watchmen in Germany in the 14th century. In the year 1563, a church-steeple was erected in Leisnig, and an apartment built in it for a permanent watchman, who was obliged to proclaim the hours every time the clock struck. Permanent watchmen were kept in many of the steeples at Ulm in the 15th century. The same thing was practised at Frankfort on the Mayne, at Oettingen, and many other places; and Montaigne was astonished at finding a man on the steeple of Constance, who kept watch

Night-Watching || Nile.

watch upon it continually, and who on no pretext whatever was permitted to come down. *Beckman's Hist. of Inventions*, iii. 425.

NIGIDIUS FIGULUS, PUBLIUS, one of the most learned men of ancient Rome, flourished at the same time with Cicero. He wrote on various subjects; but his pieces appeared so refined and difficult that they were not regarded. He assisted Cicero, with great prudence, in defeating Catiline's conspiracy, and did him many services in the time of his adversity. He adhered to Pompey in opposition to Cæsar; which occasioned his exile, he dying in banishment. Cicero, who had always entertained the highest esteem for him, wrote a beautiful consolatory letter to him (the 13th of lib. iv. *ad Familiares*).

NIGRINA, a genus of plants belonging to the pentandria class. See BOTANY *Index*.

NIGRINE, an ore of titanium. See MINERALOGY *Index*.

NIGRITIA. See NEGROLAND.

NIGUA. See CHEGOE.

NILE, a large and celebrated river of Africa, to which the country of Egypt owes its fertility; and the exploring the sources of which, has from the remotest ages, been accounted an impracticable undertaking. This problem has been solved by James Bruce, Esq. of Kinnaird, in Scotland; who spent several years at the court of Abyssinia, and by the favour of the emperor and great people of the country was enabled to accomplish the arduous task.

In the account of his travels, this gentleman has been at particular pains to show, that none of those who undertook this task ever succeeded in it but himself. The inquiry concerning its springs, he says, began either before history or tradition, and is by some supposed to be the origin of hieroglyphics. Though Egypt was the country which received the greatest benefit from this river, it was not there that the inquiries concerning its inundation began: it being probable that every thing relative to the extent and periodical time of that inundation would be accurately settled (which could not be done but by a long series of observations) before any person would venture to build houses within its reach.

The philosophers of Meroe, in our author's opinion, were the first who undertook to make a number of observations sufficient to determine these points; their country being so situated, that they could perceive every thing relative to the increase or decrease of the river without any danger from its overflowing. Being much addicted to astronomy, it could not long escape them, that the heliacal rising of the dog-star, was a signal for Egypt to prepare for the inundation; without which it was vain to expect any crop. The connection of this celestial sign with the annual rising of the river would undoubtedly soon become a matter of curiosity; and as this could not easily be discovered, it was natural for an ignorant and superstitious people to ascribe the whole to the action of the dog-star as a deity. Still, however, by those who were more enlightened, the phenomenon would be ascribed to natural causes; and a great step towards the discovery of these, undoubtedly was that of the sources of the river itself. In the early ages, when travelling into foreign countries was impracticable by private persons, the inquiry into the sources of the Nile became an object to the greatest monarchs. Sesostris is said to have preferred the honour of discovering them almost to all the victories he obtained. Alexander the Great is well known to have had a great curiosity to discover these fountains. On his arrival at the temple of Jupiter Ammon, he is said to have made inquiry concerning the fountains of the Nile, even before he asked about his own descent from Jupiter. The priests are said to have given him proper directions for finding them: and Alexander took the most ready means of accomplishing his purpose, by employing natives of Ethiopia to make the search. These discoverers, in the opinion of Mr Bruce, missed their aim, by reason of the turn which the Nile takes to the east in the latitude of 9° where it begins to surround the kingdom of Gojam; but which they might imagine to be only a winding of the river soon to be compensated by an equal turn to the west. "They therefore (says he) continued their journey south till near the line, and never saw it more; as they could have no possible notion it had turned back behind them, and that they had left it as far north as latitude 9°. They reported then to Alexander, what was truth, that they had ascended the Nile, as far south as latitude 9°; where it unexpectedly took its course to the east, and was seen no more. The river was not known, nor to be heard of near the line, or farther southward, nor was it diminished in size, nor had it given any symptom that they were near its source; they had found the Nile *calentem* (warm), while they expected its rise among melting snows.

Nile.

Mr Bruce is of opinion that this turn of the Nile to the eastward was the occasion of Alexander's extravagant mistake, in supposing that he had discovered the fountains of the Nile when he was near the source of the Indus; and which he wrote to his mother, though he afterwards caused it to be erased from his books.

Ptolemy Philadelphus succeeded Alexander in his attempts to discover the source of the Nile; but he likewise proving unsuccessful, the task was next undertaken by Ptolemy Euergetes, the most powerful of the Greek princes who sat on the throne of Egypt. "In this (says Mr Bruce) he had probably succeeded, had he not mistaken the river itself. He supposed the Siris, now the Tacazze, to be the Nile; and ascending in the direction of its stream, he came to Axum, the capital of Sire and of Ethiopia. But the story he tells of the snow which he found knee-deep on the mountains of Samen, makes me question whether he ever crossed the Siris, or was himself an ocular witness of what he says he observed there."

Cæsar had the same curiosity with other conquerors to visit the springs of the Nile, though his situation did not allow him to make any attempt for that purpose. Nero, however, was more active He sent two centurions into Ethiopia, with orders to explore the unknown fountains of this river; but they returned without having accomplished their errand. They reported, that, after having gone a long way, they came to a king of Ethiopia, who furnished them with necessaries, and recommendations to some other kingdoms adjacent; passing which, they came to immense lakes, of which nobody knew the end, nor could they ever hope to find it. Their story, however, is by Mr Bruce supposed to be a fiction;

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fiction; as the Nile forms no lakes throughout its course, excepting that of Tzana or Dembea, the limits of which are easily perceived.

No other attempt was made by the ancients to discover the sources of this celebrated river; and the matter was looked upon to be an impossibility, insomuch that *caput Nili quærere* became a proverb, denoting the impossibility of any undertaking. The first who, in more modern ages, made any attempt of this kind, was a monk sent into Abyssinia in the year 522, by Nonnosus, ambassador from the emperor Justin. This monk is called *Cosmas the Hermit*, and likewise *Indoplaustes*, from his supposed travels into India. He proceeded as far as the city of Axum, but did not visit that part of the country where the head of the Nile lies; nor, in Mr Bruce's opinion, would it have been practicable for him to do so. The discovery, however, is said to have been made at last by Peter Paez the missionary. But the truth of this account is denied by Mr Bruce, for the following reasons: 1. "No relation of this kind (says he) was to be found in three copies of Peter Paez's history, to which I had access when in Italy, on my return home. One of these copies I saw at Milan; and, by the interest of friends, had an opportunity of perusing it at my leisure. The other two were at Bologna and Rome. I ran through them rapidly; attending only to the place where the description ought to have been, and where I did not find it: but having copied the first and last page of the Milan manuscript, and comparing them with the two last mentioned, I found that all the three were word for word the same, and none of them contained one syllable of the discovery of the source. 2. Alphonso Mendez came into Abyssinia about a year after Paez's death. New and desirable as that discovery must have been to himself, to the pope, king of Spain, and all his great patrons in Portugal and Italy; though he wrote the history of the country, and of the particulars concerning the mission in great detail and with good judgment, yet he never mentions this journey of Peter Paez, though it probably must have been conveyed to Rome and Portugal after his inspection and under his authority. 3. Balthazar Tellez, a learned Jesuit, has wrote two volumes in folio, with great candour and impartiality, considering the spirit of those times; and he declares his work to be compiled from those of Alphonso Mendez the patriarch, from the two volumes of Peter Paez, as well as from the regular reports made by the individuals of the company in some places, and by the provincial letters in others; to all which he had complete access, as also to the annual reports of Peter Paez, among the rest from 1598 to 1622; yet Tellez makes no mention of such a discovery, though he is very particular as to the merit of each missionary during the long reign of Facilidas, which occupies more than half the two volumes."

The first, and indeed the only account of the fountains of the Nile, published before that of Mr Bruce, was Kircher's; who says that he took it from the writings of Peter Paez. The time when the discovery is said to have been made was the 21st of April 1618; at which season the rains are begun, and therefore very unwholesome; so that the Abyssinian armies are not without extreme necessity in the field; between September and February at farthest is the time they are abroad from the capital and in action.

"The river (says Kircher) at this day, by the Ethiopians is called *Abavy*; it rises in the kingdom of Gojam, in a territory called *Sabala*, whose inhabitants are called *Agows*. The source of the Nile is situated in the west part of Gojam, in the highest part of a valley, which resembles a great plain on every side surrounded by high mountains. On the 21st of April 1618, being here, together with the king and his army, I ascended the place, and observed every thing with great attention: I discovered first two round fountains each about four palms in diameter, and saw, with the greatest delight, what neither Cyrus the Persian, nor Cambyses, nor Alexander the Great, nor the famous Julius Cæsar, could ever discover. The two openings of these fountains have no issue in the plain on the top of the mountain, but flow from the root of it. The second fountain lies about a stone-cast west from the former: the inhabitants say that this whole mountain is full of water; and add, that the whole plain about the fountain is floating and unsteady, a certain mark that there is water concealed under it; for which reason the water does not overflow at the fountain, but forces itself with great violence out at the foot of the mountain. The inhabitants, together with the emperor, who was then present with his army, maintain that that year it trembled very little on account of the drought; but in other years, that it trembled and overflowed so that it could scarce be approached without danger. The breadth of the circumference may be about the cast of a sling: below the top of this mountain the people live about a league distant from the fountain to the west; and this place is called *Geesh*; and the fountain seems to be about a cannon-shot distant from Geesh; moreover the field where the fountain is, is on all sides difficult of access, except on the north side, where it may be ascended with ease."

On this relation Mr Bruce observes, that there is no such place as *Sabala*; it ought to have been named *Sacala*, signifying the highest ridge of land, where the water falls equally down on both sides, from east and west, or from north and south. So the sharp roofs of our houses, where the water runs down equally on the opposite sides, are called by the same name. Other objections are drawn from the situation of places, and from the number and situation of the fountains themselves, every one of which Mr Bruce found by actual mensuration to be different from Kircher's account. The following, however, he looks upon to be decisive that Paez never was on the spot. He says, "the field in which the fountains of the Nile are, is of very difficult access; the ascent to it being very steep, excepting on the north, where it is plain and easy. Now, if we look at the beginning of this description, we should think it would be the descent, not the ascent, that would be troublesome; for the fountains were placed in a valley, and people rather *descend* into valleys than *ascend* into them; but supposing it was a valley in which there was a field upon which there was a mountain, and on the mountain these fountains; still, I say, that these mountains are nearly inaccessible on the three sides; but that the most difficult of them all is the north, the way we ascend from the plain of Goutto. From the east, by Sacala, the ascent is made from the valley of Litechambara, and from the plain of Assoa to the south you have the almost perpendicular craggy cliff of Geesh, covered with thorny

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Peter Heiling, a Protestant of Lubec, resided several years in the country of Gojam, and was even governor of it, but he never made any attempt to discover the source of the Nile; dedicating himself entirely to a studious and solitary life. The most extraordinary attempt, however, that ever was made to discover the source of this or any other river, was that of a German nobleman named *Peter Joseph de Roux*, comte de Desreval. He had been in the Danish navy from the year 1721; and, in 1739, was made rear-admiral. That same year he resigned his commission, and began his attempt to discover the source of the Nile in Egypt. To this country he took his wife along with him; and had no sooner reached Cairo, than he quarrelled with a Turkish mob on a point of etiquette; which instantly brought upon them the janizaries and guards of police, to take them into custody. The countess exerted herself in an extraordinary manner; and armed only with a pair of scissars, put all the janizaries to flight, and even wounded several of them; so that her husband was left at liberty to pursue his plan of discovery. To accomplish this, he provided a barge with small cannon, and furnished with all necessary provisions for himself and his wife, who was still to accompany him. Before he set out, however, it was suggested to him, that, supposing government might protect him so far as to allow his barge to pass the confines of Egypt safely, and to the first cataract; supposing also that she was arrived at Ibrim, or Deir, the last garrisons depending on Cairo; yet still some days journey above the garrisons of Deir and Ibrim began the dreadful deserts of Nubia; and farther south, at the great cataract of Jan Adel, the Nile falls 20 feet down a perpendicular rock—so that here his voyage must undoubtedly end. The count, however, flattered himself with being able to obtain such assistance from the garrisons of Ibrim and Deir as would enable him to take the vessel to pieces, and to carry it above the cataract, where it could be again launched into the river. To facilitate this scheme he had even entered into a treaty with some of the barbarians named *Kennouss*, who reside near the cataract, and employ themselves in gathering sena, which abounds in their country. These promised to assist him in this extraordinary adventure; but, luckily for the count, he suffered himself at last to be persuaded by some Venetian merchants at Cairo not to proceed in person on such a dangerous and unheard of navigation, but rather to depute Mr Norden, his lieutenant, who was likewise to serve as his draughtsman, to reconnoitre the forts of Ibrim and Deir, as well as the cataract of Jan Adel, and renew his treaty with the Kennouss. This gentleman accordingly embarked upon one of the vessels common on the Nile, but met with a great many difficulties and disasters before he could reach Syene and the first cataract; after which having with still greater difficulty reached Ibrim, instead of meeting with any encouragement for the count to proceed on his voyage, he was robbed of all he had by the governor of the fort, and narrowly escaped with his life; it having been for some time determined by him and his soldiers that Mr Norden should be put to death. By these difficulties the count was so much disheartened, that he determined to make no more attempts on the Nubian side. He now resolved to enter Abyssinia by the island of Masuah. With this view he undertook a voyage round the Cape of Good Hope, in order to reach the Red sea by the straits of Babelmandel: but having begun to use his Spanish commission, and taken two English ships, he was met by Commodore Barnet, who made prizes of all the vessels he had with him, and sent home the count himself passenger in a Portuguese ship to Lisbon.

Thus Mr Bruce considers himself as the first European who reached the sources of this river. He informs us that they are in the country of the Agows, as Kircher had said; so that the latter must either have visited them himself, or have had very good information concerning them. The name of the place through which is the passage to the territory of the Agows, is *Abala*; a plain, or rather valley, generally about half a mile, and never exceeding a whole mile, in breadth. The mountains which surround it are at first of an inconsiderable height, covered to the very top with herbage and acacia trees; but as they proceed to the southward they become more rugged and woody.—On the top of these mountains are delightful plains producing excellent pasture. Those to the west join a mountain called *Aformaska*, where, from a direction nearly south-east, they turn south and enclose the villages and territory of Sacala, which lie at the foot of them; and still lower, that is, more to the westward, is the small village of Geesh, where the fountains of the Nile are situated. Here the mountains are in the form of a crescent; and along these the river takes its course. Those which enclose the east side of the plain run parallel to the former in their whole course, making part of the mountains of Lechtambara, or at least joining with them, and these two, when behind Aformaska, turn to the south, and then to the south-west, taking the same form as they do; only making a greater curve, and enclosing them likewise in the form of a crescent, the extremity of which terminates immediately above a small lake named *Gooderoo* in the plain of Assoa, below Geesh, and directly at the fountains of the Nile.

Having passed several considerable streams, all of which empty themselves into the Nile, our traveller found himself at last obliged to ascend a very steep and rugged mountain, where no other path was to be found but a very narrow one made by the sheep or goats, and which in some places was broken, and full of holes; in others, he was obstructed with large stones, which seemed to have remained there since the creation. The whole was covered with thick wood; and he was everywhere stopped by the kantuffa, as well as by several other

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thorny plants almost as troublesome as that. Having at last, however, reached the top, he had a sight of the Nile immediately below him; but so diminished in size, that it now appeared only a brook scarcely sufficient to turn a mill. The village of Geesh is not within sight of the fountains of the river, though not more than 600 yards distant from them. The country about that place terminates in a cliff of about 300 yards high, which reaches down to the plain of Assoa, continuing in the same degree of elevation till it meets the Nile again about 17 miles to the southward, after having made the circuit of the provinces of Gojam and Damot. In the middle of this cliff is a vast cave running straight northward, with many bye paths forming a natural labyrinth, of sufficient bigness to contain the inhabitants of the whole village with their cattle. Into this Mr Bruce advanced about 100 yards; but he did not choose to go farther, as the candle he carried with him seemed ready to go out; and the people assured him that there was nothing remarkable to be seen at the end. The face of this cliff, fronting the south, affords a very picturesque view from the plain of Assoa below; parts of the houses appearing at every stage through the bushes and thickets of trees. The mouths of the cavern above mentioned, as well as of several others which Mr Bruce did not see, are hid by almost impenetrable fences of the worst kind of thorn; nor is there any other communication betwixt the upper part and the houses but by narrow winding sheep paths, very difficult to be discovered; all of them being allowed to be overgrown, as a part of the natural defence of the people. The edge of the cliff is covered with lofty and high trees, which seem to form a natural fence to prevent people from falling down; and the beauty of the flowers which the Abyssinian thorns bear, seems to make some amends for their bad qualities. From the edge of the cliff of Geesh, above where the village is situated, the ground slopes with a descent due north, till we come to a triangular marsh upwards of 86 yards broad, and 286 from the edge of the cliff, and from a priest's house where Bruce resided. On the east, the ground descends with a very gentle slope from the large village of Sacala, which gives its name to the territory, and is about six miles distant from the source, though to appearance not above two. About the middle of this marsh, and not quite 40 yards from the foot of the mountain of Geesh, rises a circular hillock about three feet from the surface of the marsh itself, though founded apparently much deeper in it. The diameter of this hillock is not quite 12 feet, and it is surrounded by a shallow trench which collects the water, and sends it off to the eastward. This is firmly built of sod brought from the sides, and kept constantly in repair by the Agows, who worship the river, and perform their religious ceremonies upon this as an altar. In the midst of it is a circular hole, in the formation or enlargement of which the work of art is evidently discernible. It is always kept clear of grass and aquatic plants, and the water in it is perfectly pure and limpid, but without any ebullition or motion discernible on its surface. The mouth is some parts of an inch less than three feet diameter, and at the time our author first visited it (Nov. 5. 1770), the water stood about two inches from the brim, nor did it either increase or diminish during all the time of his residence at Geesh. On putting down the shaft of a lance, he found a very feeble resistance at six feet four inches, as if from weak rushes and grass; and, about six inches deeper, he found his lance had entered into soft earth, but met with no obstruction from stones or gravel; and the same was confirmed by using a heavy plummet, with a line besmeared with soap.—This is the first fountain of the Nile.

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The second fountain is situated at about ten feet distant from the former, a little to the west of south; and is only 11 inches in diameter, but eight feet three inches deep. The third is about 20 feet SSW from the first; the mouth being somewhat more than two feet in diameter, and five feet eight inches in depth. These fountains are made use of as altars, and from the foot of each issues a brisk running rill, which, uniting with the water of the first trench, goes off at the east side in a stream which, our author conjectures, would fill a pipe about two inches diameter. The water of these fountains is extremely light and good, and intensely cold, though exposed to the scorching heat of the sun, without any shelter; there being no trees nearer than the cliff of Geesh. The longitude of the principal fountain was found by Mr Bruce to be 36° 55′ 30″ E. from Greenwich. The elevation of the ground, according to his account, must be very great, as the barometer stood only at 22 English inches. "Neither (says he) did it vary sensibly from that height any of the following days I staid at Geesh; and thence I inferred, that at the sources of the Nile I was then more than two miles above the level of the sea; a prodigious height, to enjoy a sky perpetually clear, as also a hot sun never overcast for a moment with clouds from rising to setting." In the morning of Nov. 6. the thermometer stood at 44°, at noon 96°, and at sunset 46°. It was sensibly cold at night, and still more so about an hour before sunrise.

The Nile thus formed by the union of streams from these three fountains, runs eastward through the marsh for about 30 yards, with very little increase of its water, but still distinctly visible, till it is met by the grassy brink of the land descending from Sacala. By this it is turned gradually NE, and then due north; and in the two miles in which it flows in that direction it receives many small streams from springs on each side; so that about this distance from the fountains it becomes a stream capable of turning a common mill. Our traveller was much taken with the beauty of this spot. "The small rising hills about us (says he) were all thick covered with verdure, especially with clover the largest and finest I ever saw; the tops of the heights covered with trees of a prodigious size: the stream, at the banks of which we were sitting, was limpid, and pure as the finest crystal; the sod covered thick with a kind of bushy tree, that seemed to affect to grow to no height, but, thick with foliage and young branches, rather to assist the surface of the water; whilst it bore, in prodigious quantities, a beautiful yellow flower, not unlike a single rose of that colour, but without thorns; and indeed, upon examination, we found that it was not a species of the rose, but of the hypericum."

Here Mr Bruce exults greatly in his success; as having not only seen the fountains of the Nile, but the river itself running in a small stream; so that the ancient saying of the poet,

Nec licuit populis parvum te Nile videre,

could not be applied to him. Here he *stepped* over it, he says, more than 50 times, though he had told us, in the preceding page, that it was *three yards* over. From this ford, however, the Nile turns to the westward; and, after

Nile. after running over loose stones occasionally in that direction about four miles farther, there is a small cataract of about six feet in height; after which it leaves the mountainous country, and takes its course through the plains of Goutto. Here it flows so gently that its motion is scarcely to be perceived, but turns and winds in its direction more than any river he ever saw; forming more than 20 sharp angular peninsulas in the space of five miles. Here the soil is composed of a marshy clay, quite destitute of trees, and very difficult to travel through; and where its stream receives no considerable addition. Issuing out from thence, however, it is joined by several rivulets which fall from the mountains on each side, so that it becomes a considerable stream, with high and broken banks covered with old timber trees for three miles. In its course it inclines to the north-east, and winds very much, till it receives first a small river named *Diwa*, and then another named *Dee-obha*, or the river Dee. Turning then sharply to the east, it falls down another cataract, and about three miles below receives the Jemma, a pure and limpid stream, not inferior in size to itself. Proceeding still to the northward, it receives a number of other streams, and at last crosses the southern part of the lake Tzana or Dembea, preserving the colour of its stream during its passage, and issuing out at the west side of it in the territory of Dara.

There is a ford, though very deep and dangerous, at the place where the Nile first assumes the name of a river, after emerging from the lake Dembea; but the stream in other places is exceedingly rapid: the banks in the course of a few miles become very high, and are covered with the most beautiful and variegated verdure that can be conceived. It is now confined by the mountains of Begemder, till it reaches Alata, where is the third cataract. This, we are informed by Mr Bruce, is the most magnificent sight he ever beheld; but he thinks that the height has rather been exaggerated by the missionaries, who make it 50 feet; and after many attempts to measure it, he is of opinion that it is nearly 40 feet high. At the time he visited it, the river had been pretty much swelled by rains, and fell in one sheet of water, without any interval, for the space of half an English mile in breadth, with such a noise as stunned and made him giddy for some time. The river, for some space both above and below the fall, was covered with a thick mist, owing to the small particles of the water dashed up into the air by the violence of the shock. The river, though swelled beyond its usual size, retained its clearness, and fell into a natural bason of rock; the stream appearing to run back against the foot of the precipice over which it falls with great violence; forming innumerable eddies, waves, and being in excessive commotion, as may easily be imagined. Jerome Lobo pretends that he was able to reach the foot of the rock, and sit under the prodigious arch of water spouting over it; but Mr Bruce does not hesitate to pronounce this to be an absolute falsehood. The noise of the cataract, which, he says, is like the loudest thunder, could not but confound and destroy his sense of hearing; while the rapid motion of the water before his eyes would dazzle the sight, make him giddy, and utterly deprive him of all his intellectual powers. "It was a most magnificent sight, (says Mr Bruce), that ages, added to the greatest length of human life, would not deface or eradicate from my memory: it struck me with a kind of stupor, and a total oblivion of where I was, and of every other sublunary concern."

About half a mile below the cataract, the Nile is confined between two rocks, where it runs in a narrow channel with impetuous velocity and a great noise. At the village of Alata there is a bridge over it, consisting of one arch, and that no more than 25 feet wide. This bridge is strongly fixed into the solid rock on both sides, and some part of the parapet still remains. No crocodiles ever come to Alata, nor are any ever seen beyond the cataract.

Below this tremendous water-fall the Nile takes a south-east direction, along the western side of Begemder and Amhara on the right, enclosing the province of Gojam. It receives a great number of streams from both sides, and after several turns takes at last a direction almost due north, and approaches within 62 miles of its source. Notwithstanding the vast increase of its waters, however, it is still fordable at some seasons of the year; and the Galla cross it at all times without any difficulty, either by swimming, or on goats skins blown up like bladders. It is likewise crossed on small rafts, placed on two skins filled with wind: or by twisting their hands round the tails of the horses who swim over; a method always used by the women who follow the Abyssinian armies, and are obliged to cross unfordable rivers. In this part of the river crocodiles are met with in great numbers: but the superstitious people pretend they have charms sufficiently powerful to defend themselves against their voracity.—The Nile now seems to have forced its passage through a gap in some very high mountains which bound the country of the Gongas, and falls down a cataract of 280 feet high; and immediately below this are two others, both of very considerable height. These mountains run a great way to the westward, where they are called *Dyre* or *Tegla*, the eastern end of them joining the mountains of Kuara, where they have the name of *Fazuclo*. These mountains, our author informs us, are all inhabited by Pagan nations; but the country is less known than any other on the African continent. There is plenty of gold washed down from the mountains by the torrents in the rainy season; which is the fine gold of Sennaar named *Tibbar*.

The Nile, now running close by Sennaar in a direction nearly north and south, makes afterwards a sharp turn to the east; affording a pleasant view in the fair season, when it is brim-full, and indeed the only ornament of that bare and inhospitable country. Leaving Senaar, it passes by many large towns inhabited by Arabs, all of them of a white complexion; then passing Gerri, and turning to the north-east, it joins the Tacazze, passing, during its course through this country, a large and populous town named *Chendi*, probably the Candace of the ancients. Here Mr Bruce supposes the ancient island or peninsula of Meroe to have been situated. Having at length received the great river Atbara, the Astaboras of the ancients, it turns directly north for about two degrees; then making a very unexpected turn west by south for more than two degrees in longitude, and winding very little, it arrives at Korti, the first town in Barabra, or kingdom of Dongola. From Korti it runs almost south-west till it passes Dongola, called also *Beja*, the capital of Barabra; after which it comes to Moscho, a considerable town and place of refreshment to the caravans when they were allowed to pass from Egypt to Ethiopia. From thence turning to the north-east it meets with a chain of mountains in about 22° 15′ of N. latitude, where is the seventh cataract named *Jan Adel*. This is likewise very tremendous, though not above half as high as that of Alata. This course is now continued till it falls into the Mediterranean; there being only one other cataract in the whole space, which is much inferior to any of those already described.

This very particular and elaborate account of the sources of the Nile and of the course of the river given by Mr Bruce, hath not escaped criticism. We find him accused by the reviewers, not only of having brought nothing to light that was not previously known to the learned, but even of having revealed nothing which was not previously published in Guthrie's Geographical Grammar. This, however, seems by no means a fair and candid criticism. If the sources of the Nile, as described by Mr Bruce, were known to the author of Guthrie's Grammar, they must likewise have been so to every retailer of geography since the time of the missionaries; which, as the reviewers have particularized that book, would not seem to have been the case. If any thing new was published there previous to the appearance of Mr Bruce's work, it must probably have been derived indirectly from himself; of which clandestine method of proceeding that gentleman has had frequent occasion to complain in other cases. It is alleged, however, that he has given the name of *Nile* to a stream which does not deserve it. This, like all other large rivers, is composed of innumerable branches; to visit the top of every one of which would be indeed an Herculean task. The source of the largest branch, therefore, and that which has the longest course, is undoubtedly to be accounted the source of the river; but here it is denied that Mr Bruce had sufficient information. "Of the innumerable streams (say they) that feed the lake of Tzana, there is one that ends in a bog, to which Mr Bruce was conducted by Woldo, a lying guide, who told him it was the source of the Nile. Mr Bruce, in a matter of far less importance, would not have taken Woldo's word; but he is persuaded, that in this case he spoke truth; because the credulous barbarians of the neighbouring district paid something like worship to this brook, which, at the distance of 14 miles from its source, is not 20 feet broad, and nowhere one foot deep. Now it is almost unnecessary to observe, that the natives of that country being, according to Mr Bruce's report, pagans, might be expected to worship the pure and salutary stream, to which, with other extraordinary qualities, their superstition ascribed the power of curing the bite of a mad dog. Had he traced to its source any of the other rivulets which run into the lake Tzana, it is not unlikely that he might have met with similar instances of credulity among the ignorant inhabitants of its banks. Yet this would not prove any one of them in particular to be the head of the Nile. It would be trifling with the patience of our readers to say one word more on the question, whether the Portuguese Jesuits or Mr Bruce discovered what they erroneously call the head of the Nile. Before either they or he had indulged themselves in a vain triumph over the labours of antiquity, they ought to have been sure that they had effected what antiquity was unable to accomplish. Now the river described by the Jesuit Kircher, who collected the information of his brethren, as well as by Mr Bruce, is not the Nile of which the ancients were in quest. This is amply proved by the prince of modern geographers, the incomparable D'Anville (at least till our own Rennel appeared), in a copious memoir published in the 26th volume of the Memoirs of the Academy of Belles Lettres, p. 45.— To this learned dissertation we refer our readers; adding only what seems probable from the writings of Diodorus Siculus and Herodotus, that the ancients had two meanings when they spoke of the head or source of the Nile: First, Literally, the head or source of that great western stream now called the *White River*, which contains a much greater weight of waters, and has a much longer course than the river described by the Jesuits and by Mr Bruce: and, 2dly, Metaphorically, the cause of the Nile's inundation.— This cause they had discovered to be the tropical rains, which fall in the extent of 16 degrees on each side of the line; which made the sacristan of Minerva's temple of Saïs in Egypt tell that inquisitive traveller Herodotus, that the waters of the Nile run in two opposite directions from its source; the one north into Egypt, the other south into Ethiopia; and the reports of all travellers into Africa serve to explain and confirm this observation. The tropical rains, they acknowledge, give rise to the Nile and all its tributary streams which flow northward into the kingdom of Sennaar, as well as to the Zebee, and so many large rivers which flow south into Ethiopia; and then, according to the inclination of the ground, fall into the Indian or Atlantic ocean. Such then, according to the Egyptian priests, is the true and philosophical source of the Nile; a source discovered above 3000 years ago, and not, as Mr Bruce and the Jesuits have supposed, the head of a paltry rivulet, one of the innumerable streams that feed the lake Tzana."

See Rennel's Map of Herodotus, p. 441.

On this severe criticism, however, it is obvious to remark, that if the source of the Nile has been discovered so many years ago, there is not the least probability that the finding of it should have been deemed an impossible undertaking, which it most certainly was, by the ancients.—That the finding out the fountains of the river itself was an object of their inquiry, cannot be doubted; and from the accounts given by Mr Bruce, it appears very evident that none of the ancients had equal success with himself; though indeed the Jesuits, as has already been observed, seem to have a right to dispute it with him. From the correspondence of his accounts with that of the Jesuits, it appears certain that the most considerable stream which flows into the lake Tzana takes its rise from the fountains at Geesh already described; and that it is the most considerable plainly appears from its stream being visible through the whole breadth of the lake, which is not the case with any of the rest. The preference given to this stream by the Agows, who worship it, seems also an incontestable proof that they look upon it to be the great river which passes through Ethiopia and Egypt; nor will the argument of the reviewers hold good in *supposing* that other streams are worshipped, unless they could prove that they are so. As little can it be any objection or disparagement

disparagement to Mr Bruce's labours, that he did not discover the sources of the western branch of the Nile called the *White River*. Had he done so, it might next have been objected that he did not visit the springs of the Tacazze, or any other branch. That the origin of the White river was unknown to the ancients may readily be allowed; but so were the fountains of Geesh, as evidently appears from the erroneous position of the sources of the eastern branch of the Nile laid down by Ptolemy. Our traveller, therefore, certainly has the merit, if not of discovering the sources, at least of confirming the accounts which the Jesuits have given of the sources, of the river called the *Nile;* and of which the White river, whether greater or smaller, seems to be accounted only a branch. The superior veneration paid to the eastern branch of this celebrated river will also appear from the variety of names given to it, as well as from the import of these names; of which Mr Bruce gives the following account.

By the Agows it is named *Gzeir*, *Gcesu*, or *Seir;* the first of which terms signifies *a god*. It is likewise named *Ab*, father; and has many other names, all of them implying the most profound veneration. Having descended into Gojam it is named *Abay;* which, according to Mr Bruce, signifies the river that suddenly swells and overflows periodically with rain. By the Gongas on the south side of the mountains Dyre and Tegla, it is called *Dahli*, and by those on the north side *Kowass;* both of which names signify a *watching dog*, the *latrator anubis*, or *dog-star*. In the plain country between Fazuclo and Sennaar it is called *Nile*, which signifies *blue;* and the Arabs interpret this name by the word *Azergue;* which name it retains till it reaches Halfaia, where it receives the White river.

Formerly the Nile had the name of *Siris*, both before and after it enters Beja, which the Greeks imagined was given to it on account of its black colour during the inundation; but Mr Bruce assures us that the river has no such colour. He affirms, with great probability, that this name in the country of Beja imports the river of the *dog-star*, on whose vertical appearance this river overflows; "and this idolatrous worship (says he) was probably part of the reason of the question the prophet Jeremiah asks: And what hast thou to do in Egypt to drink the water of Seir, or the water profaned by idolatrous rites?" As for the first, it is only the translation of the word *bahar* applied to the Nile. The inhabitants of the Barabra to this day call it *Bahar el Nil*, or the sea of the Nile, in contradistinction to the Red sea, for which they have no other name than *Bahar el Molech*, or the Salt sea. The junction of the three great rivers, the Nile flowing on the west side of Meroe; the Tacazze, which washes the east side, and joins the Nile at Maggiran in N. Lat. 17°; and the Mareb, which falls into this last something above the junction, gives the name of *Triton* to the Nile.

The name *Ægyptus*, which it has in Homer, and which our author supposes to have been a very ancient name even in Ethiopia, is more difficult to account for. This has been almost universally supposed to be derived from the black colour of the inundation; but Mr Bruce, for the reasons already given, will not admit of this. "Egypt (says he) in the Ethiopic is called *y Gipt*, Agar; and an inhabitant of the country, *Gypt*, for precisely so it is pronounced; which means the country of ditches or canals, drawn from the Nile on both sides at right angles with the river: nothing surely is more obvious than to write *y Gipt*, so pronounced, *Egypt;* and, with its termination *us* or *os*, *Egyptus*. The Nile is also called *Kronides*, Jupiter; and has had several other appellations bestowed upon it by the poets; though these are rather of a transitory nature than to be ranked among the ancient names of the river. By some of the ancient fathers it has been named *Geon;* and by a strange train of miracles they would have it to be one of the rivers of the terrestrial paradise; the same which is said to have encompassed the whole land of Cush or Ethiopia. To effect this, they are obliged to bring the river a great number of miles, not only under the earth, but under the sea also; but such reveries need no refutation.

Under the article EGYPT we have so fully explained the cause of the annual inundation of the Nile, that, with regard to the phenomenon itself, nothing farther seems necessary to be added. We shall therefore only extract from Mr Bruce's work what he has said concerning the mode of natural operation by which the tropical rains are produced; which are now universally allowed to be the cause of the annual overflowing of this and other rivers.

According to this gentleman, the air is so much rarefied by the sun during the time that he remains almost stationary over the tropic of Capricorn, that the other winds loaded with vapours rush in upon the land from the Atlantic ocean on the west, the Indian ocean on the east, and the cold Southern ocean beyond the Cape. Thus a great quantity of vapour is gathered, as it were, into a focus; and as the same causes continue to operate during the progress of the sun northward, a vast train of clouds proceed from south to north, which, Mr Bruce informs us, are sometimes extended much farther than at other times. Thus he tells us, that for two years some white dappled clouds were seen at Gondar, on the 7th of January; the sun being then 34° distant from the zenith, and not the least cloudy speck having been seen for several months before. About the first of March, however, it begins to rain at Gondar, but only for a few minutes at a time, in large drops; the sun being then about 5° distant from the zenith. The rainy season commences with violence at every place when the sun comes directly over it; and before it commences at Gondar, green boughs and leaves appear floating in the Bahar el Abiad, or White river, which, according to the accounts given by the Galla, our author supposes to take its rise in about 5° north latitude.

The rains therefore precede the sun only about 5°; but they continue and increase after he has passed it. In April all the rivers in the southern parts of Abyssinia begin to swell, and greatly augment the Nile, which is now also farther augmented by the vast quantity of water poured into the lake Tzana. On the first days of May, the sun passes the village of Gerri, which is the limit of the tropical rains; and it is very remarkable, that, though the sun still continues to operate with unabated vigour, all his influence cannot bring the clouds farther northward than this village;

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the reason of which Mr Bruce, with great reason, supposes, to be the want of mountains to the northward. In confirmation of this opinion, he observes, that the tropical rains stop at the latitude of 14° instead of 16° in the western part of the continent. All this time, however, they continue violent in Abyssinia; and in the beginning of June the rivers are all full, and continue so while the sun remains stationary in the tropic of Cancer.

This excessive rain, which would sweep off the whole soil of Egypt into the sea were it to continue without intermission, begins to abate as the sun turns southward; and on his arrival at the zenith of each place, on his passage towards that quarter, they cease entirely: the reason of which is no less difficult to be discovered than that of their coming on when he arrives at the zenith in his passage northward. Be the reason what it will, however, the fact is certain; and not only so, but the time of the rains ceasing is exact to a single day; insomuch, that on the 25th of September the Nile is generally found to be at its highest at Cairo, and begins to diminish every day after. Immediately after the sun has passed the line, he begins the rainy season to the southward; the rains constantly coming on with violence as he approaches the zenith of each place; but the inundation is now promoted in a different manner, according to the difference of circumstances in the situation of the places. From about 6° S. Lat. a chain of high mountains runs all the way along the middle of the continent towards the Cape of Good Hope, and intersects the southern part of the peninsula nearly in the same manner that the Nile does the northern. A strong wind from the south, stopping the progress of the condensed vapours, dashes them against the cold summits of this ridge of mountains, and forms many rivers, which escape in the direction either of east or west as the level presents itself. If this is towards the west, they fall down the sides of the mountains into the Atlantic, and if on the east into the Indian ocean.—"The clouds (says Mr Bruce), drawn by the violent action of the sun, are condensed, then broken, and fall as rain on the top of this high ridge, and swell every river; while a wind from the ocean on the east blows like a monsoon, up each of these streams, in a direction contrary to their current during the whole time of the inundation; and this enables boats to ascend into the western parts of Sofala, and the interior country, to the mountains where lies the gold. The same effect, from the same cause, is produced on the western side towards the Atlantic; the high ridge of mountains being placed between the different countries west and east, is at once the source of their riches, and of those rivers which conduct to the treasures, which would be otherwise inaccessible, in the eastern parts of the kingdoms of Benin, Congo, and Angola.

"There are three remarkable appearances attending the inundation of the Nile. Every morning in Abyssinia is clear, and the sun shines. About nine, a small cloud not above four feet broad, appears in the east, whirling violently round as if upon an axis; but arrived near the zenith, it first abates its motion, then loses its form, and extends itself greatly, and seems to call up vapours from all the opposite quarters. These clouds having attained nearly the same height, rush against each other with great violence, and put me always in mind of Elisha foretelling rain on Mount Carmel. The air, impelled before the heaviest mass, or swiftest mover, makes an impression of its form on the collection of clouds opposite; and the moment it has taken possession of the space made to receive it, the most violent thunder possible to be conceived instantly follows, with rain: after some hours the sky again clears, with a wind at north: and it is always disagreeably cold when the thermometer is below 63°.

"The second thing remarkable is the variation of the thermometer. When the sun is in the southern tropic, 36° distant from the zenith of Gondar, it is seldom lower than 72°; but it falls to 60°, and 63°, when the sun is immediately vertical; so happily does the approach of rain compensate the heat of a too scorching sun.

"The third is that remarkable stop in the extent of the rain northward, when the sun that has conducted the vapours from the line, and should seem now more than ever to be in the possession of them, is here overruled suddenly; till, on his return to Gerri, again it resumes the absolute command over the rain, and reconducts it to the line, to furnish distant deluges to the southward."

With regard to the Nile itself, it has been said that the quantity of earth brought down by it from Abyssinia is so great, that the whole land of Egypt is produced from it. This question, however, is discussed under the article EGYPT, where it is shown that this cannot possibly be the case.—Among other authorities there quoted was that of Mr Volney, who strenuously argues against the opinion of Mr Savary and others, who have maintained that Egypt is the gift of the Nile. Notwithstanding this, however, we find them asserting that the soil of Egypt has undoubtedly been augmented by the Nile, in which case it is not unreasonable to suppose that it has been produced by it altogether.—"The reader (says he) will conclude, doubtless, from what I have said, that writers have flattered themselves too much in supposing they could fix the precise limits of the enlargement and rise of the Delta. But, though I would reject all illusory circumstances, I am far from denying the fact to be well founded; it is plain from reason, and an examination of the country. The rise of the ground appears to be demonstrated by an observation on which little stress has been laid. In going from Rosetta and Cairo, when the waters are low, as in the month of March, we may remark, as we go up the river, that the shore rises gradually above the water; so that if overflowed two feet at Rosetta, it overflows from three to four at Faona, and upwards of twelve at Cairo (A). Now by reasoning from this fact, we may deduce the proof of an increase by sediment; for the layer of mud being in proportion to the thickness of the sheets of water by which it is deposited, must be more or less considerable

(A) "It would be curious to ascertain in what proportion it continues up to Asouan. Some Copts, whom I have interrogated on the subject, assured me that it was much higher through all the Said than at Cairo."

considerable as these are of a greater or less depth; and we have seen that the like gradation is observable from Asouan to the sea.

"On the other hand, the increase of the Delta manifests itself in a striking manner, by the form of Egypt along the Mediterranean. When we consider its figure on the map, we perceive that the country which is in the line of the river, and evidently formed of foreign materials, has assumed a semicircular shape, and that the shores of Arabia and Africa, on each side, have a direction towards the bottom of the Delta; which manifestly discovers that this country was formerly a gulf, that in time has been filled up.

"This accumulation is common to all rivers, and is accounted for in the same manner in all: the rain water and the snow descending from the mountains into the valleys, hurry incessantly along with them the earth they wash away in their descent. The heavier parts, such as pebbles and sands, soon stop, unless forced along by a rapid current. But when the waters meet only with a fine and light earth, they carry away large quantities with the greatest facility. The Nile, meeting with such a kind of earth in Abyssinia and the interior parts of Africa, its waters are loaded and its bed filled with it; nay, it is frequently so embarrassed with this sediment as to be straitened in its course. But when the inundation restores to it its natural energy, it drives the mud that has accumulated towards the sea, at the same time that it brings down more for the ensuing season; and this, arrived at its mouth, heaps up, and forms shoals, where the declivity does not allow sufficient action to the current, and where the sea produces an equilibrium of resistance. The stagnation which follows occasions the grosser particles, which till then had floated, to sink; and this takes place more particularly in those places where there is least motion, as towards the shores, till the sides become gradually enriched by the spoils of the upper country and of the Delta itself; for if the Nile takes from Abyssinia to give to the Thebais, it likewise takes from the Thebais to give to the Delta, and from the Delta to carry to the sea. Wherever its waters have a current, it despoils the same territory that it enriches. As we ascend towards Cairo, when the river is low, we may observe the banks worn steep on each side and crumbling in large flakes. The Nile, which undermines them, depriving their light earth of support, it falls into the bed of the river; for when the water is high, the earth imbibes it; and when the sun and drought return, it cracks and moulders away in great flakes, which are hurried along by the Nile."

Thus does Mr Volney argue for the increase of the Delta in the very same manner that others have argued for the production of the whole country of Egypt; an opinion which he is at great pains to refute. Under the article EGYPT, however, it is shown that the Nile does not bring down any quantity of mud sufficient for the purposes assigned; and with regard to the argument drawn from the shallowness of the inundation when near the sea, this does not prove any rise of the land; but as Mr Rennel has judiciously observed in his remarks on the inundation of the Ganges, arises from the nature of the fluid itself. The reason, in short, is this: The surface of the sea is the lowest point to which the waters of every inundation have a tendency; and when they arrive there, they spread themselves over it with more ease than any where else, because they meet with less resistance. Their motion, however, by reason of the small declivity, is less swift than that of the waters farther up the river, where the declivity is greater; and consequently the latter being somewhat impeded in their motion, are in some degree accumulated. The surface of the inundation, therefore, does not form a perfectly level plain, but one gradually sloping from the interior parts of the country towards the sea; so that at the greatest distance from the ocean the water will always be deepest, even if we should suppose the whole country to be perfectly smooth, and composed of the most solid materials.—This theory is easily understood from observing a quantity of water running along a wooden spout, which is always more shallow at the end of the spout where it runs off than at the others.—With regard to Mr Volney's other arguments, they are without doubt contradictory; for if, as he says, the river takes from Abyssinia to give to the Thebais, from Thebais to give to the Delta, and from Delta to the sea, it undoubtedly follows, that it gives nothing to any part of the land whatever, but that altogether is swept into the Mediterranean sea, which, indeed, some very trifling quantities excepted, is most probably the case.

It has been remarked by Mr Pococke, a very judicious traveller, that in the beginning of the inundation, the waters of the Nile run red, and sometimes green; and while they remain of that colour, they are unwholesome. He explains this phenomenon by supposing, that the inundation at first brings away that red or green filth which may be about the lakes where it takes its rise; or about the sources of the small rivers which flow into it, near its principal source; "for, says he, although there is so little water in the Nile when at lowest, that there is hardly any current in many parts of it, yet it cannot be supposed that the water should stagnate in the bed of the Nile so as to become green. Afterwards the water begins to be red and still more turbid, and then it begins to be wholesome." This circumstance is explained by Mr Bruce in the following manner: the country about Narea and Caffa, where the river Abiad takes its rise, is full of immense marshes, where, during the dry season, the water stagnates, and becomes impregnated with every kind of corrupted matter. These on the commencement of the rains, overflow into the river Abiad, which takes its rise there. The overflowing of these vast marshes first carries the discoloured water into Egypt; after which follows that of the great lake Tzana, through which the Nile passes; which having been stagnated, and without rain, under a scorching sun for six months, joins its putrid waters to the former. In Abyssinia also, there are very few rivers that run after November, but all of them stand in prodigious pools, which, by the heat of the sun, likewise turn putrid, and on the commencement of the rains throw off their stagnant water into the Nile; but at last, the rains becoming constant, all this putrid matter is carried off, and the sources of the inundation become sweet and wholesome. The river then passing through the kingdom of Sennaar, the soil of which is this red bole, becomes coloured with that earth; and a mixture, along with the moving sands of the deserts, of which it receives

Nile receives a great quantity when raised by the wind, precipitates all the viscous and putrid matters which float in the waters; whence Mr Pococke judiciously observes, that the Nile is not wholesome when the water is clear and green, but when so red and turbid that it stains the water of the Mediterranean.

The rains in Abyssinia, which cease about the 8th of September, generally leave a sickly season in the low country; but the diseases produced by these rains are removed by others which come on about the end of October, and cease about the 8th of November. On these rains depend the latter crops of the Abyssinians; and for these the Agows pray to the river, or the genius or spirit residing in it. In Egypt, however, the effect of them is seldom perceived; but in some years they prove excessive; and it has been observed that the Nile, after it has fallen, has again risen in such a manner as to alarm the whole country. This is said to have happened in the time of Cleopatra, when it was supposed to presage the extinction of the government of the Ptolemies; and in 1737 it was likewise imagined to portend some dreadful calamity.

The quantity of rain, by which all this inundation is occasioned, varies considerably in different years, at least at Gondar, where Mr Bruce had an opportunity of measuring it. In 1770 it amounted to $35\frac{1}{7}$ inches; but in 1771 it amounted to no less than 41,355 inches from the vernal equinox to the 8th of September. What our author adds concerning the variation of the rainy months seems totally irreconcilable with what he had before advanced concerning the extreme regularity of the natural causes by which the tropical rains are produced. "In 1770 (says he) August was the rainy month; in 1771, July. When July is the rainy month, the rains generally cease for some days in the beginning of August, and then a prodigious deal falls in the latter end of that month and first week of September. In other years July and August are the violent rainy months, while June is fair. And lastly, in others, May, June, July, August, and the first week of September." If this is the case, what becomes of the regular attraction of the clouds by the sun as he advances northwards; of the coming on of the rains when he arrives at the zenith of any place, in his passage to the tropic of Cancer; and of their ceasing when he comes to the same point in his return southward?

Under ABYSSINIA we have mentioned a threat of one of the Abyssinian monarchs, that he would direct the course of the Nile, and prevent it from fertilizing the land of Egypt; and it has likewise been related, that considerable progress was made in this undertaking by another emperor. Mr Bruce has bestowed an entire chapter on the subject; and is of opinion, that "there seems to be no doubt that it is possible to diminish or divert the course of the Nile, that it should be insufficient to fertilize the country of Egypt; because the Nile, and all the rivers that run into it, and all the rains that swell these rivers, fall in a country two miles above the level of the sea; therefore it cannot be denied, that there is level enough to divert many of the rivers into the Red sea, or perhaps still easier by turning the course of the river Abiad till it meets the level of the Niger, or pass through the desert into the Mediterranean." Alphonso Albuquerque is said to have written frequently to the king of Portugal to send him pioneers from Madeira, with people accustomed to level grounds, and prepare them for sugar canes; by whose assistance he meant to turn the Nile into the Red sea. This undertaking, however, if it really had been projected, was never accomplished; nor indeed is there any probability that ever such a mad attempt was proposed. Indeed, though we cannot deny that there is a possibility in nature of accomplishing it, yet the vast difficulty of turning the course of so many large rivers may justly stigmatize it as impracticable; not to mention the obstacles which must naturally be suggested from the apparent inutility of the undertaking, and those which would arise from the opposition of the Egyptians.

It has already been observed, in a quotation from the reviewers, that Herodotus was informed by the sacristan or secretary of the treasury of Minerva, that one half of the waters of the Nile run north and the other south. This is also taken notice of by Mr Bruce; who gives the following explanation of it. "The secretary was probably of that country himself, and seems by his observation to have known more of it than all the ancients together. In fact we have seen, that between 13° and 14° north latitude, the Nile, with all its tributary streams, which have their rise and course within the tropical rains, falls down into the flat country (the kingdom of Sennaar), which is more than a mile lower than the high country in Abyssinia; and thence, with a little inclination, it runs into Egypt. Again, In latitude 9°, in the kingdom of Gingiro, the Zebee runs south or south-east, into the Inner Ethiopia, as do also many other rivers, and, as I have heard from the natives of that country, empty themselves into a lake, as those on the north side of the line do into the lake Tzana, thence distributing their waters to the east and west. These become the heads of great rivers, that run through the interior countries of Ethiopia (corresponding to the sea coast of Melinda and Mombaza) into the Indian ocean; whilst, on the westward, they are the origin of the vast streams that fall into the Atlantic, passing through Benin and Congo, southward of the river Gambia and the Sierra Leona. In short, the periodical rains from the tropic of Capricorn to the line, being in equal quantity with those that fall between the line and the tropic of Cancer, it is plain, that if the land of Ethiopia sloped equally from the line southward and northward, the rains that fall would go the one half north and the other half south; but as the ground from 5° north declines all southward, it follows, that the rivers which run to the southward must be equal to those that run northward, *plus* the rain that falls in the 5° north latitude, where the ground begins to slope to the southward; and there can be little doubt that is at least one of the reasons why there are in the southern continent so many rivers larger than the Nile, that run both into the Indian and Atlantic oceans."

From this account given to Herodotus, it has been supposed, by some writers on geography, that the Nile divides itself into two branches, one of which runs northward into Egypt, and one through the country of the Negroes westward into the Atlantic ocean. This opinion was first broached by Pliny.—It has been adopted by the Nubian geographer, who urges

urges in support of it, that if the Nile carried down all the rains which fall into it from Abyssinia, the people of Egypt would not be safe in their houses. But to this Mr Bruce answers, that the waste of water in the burning deserts through which the Nile passes is so great, that unless it was supplied by another stream, the White River, equal in magnitude to itself, and which, rising in a country of perpetual rains, is thus always kept full, it never could reach Egypt at all, but would be lost in the sands, as is the case with many other very considerable rivers in Africa. "The rains (says he) are collected by the four great rivers in Abyssinia; the Mareb, the Bowiha, the Tacazze, and the Nile. All these principal, and their tributary streams, would, however, be absorbed, nor be able to pass the burning deserts, or find their way into Egypt, were it not for the White River, which having its source in a country of almost perpetual rains, joins to it a never-failing stream equal to the Nile itself."

We shall conclude this article with some account of the Agows who inhabit the country about the sources of the Nile. These, according to Mr Bruce, are one of the most considerable nations in Abyssinia, and can bring into the field about 4000 horse and a great number of foot; but were once much more powerful than they are now, having been greatly reduced by the invasions of the Galla. Their province is nowhere more than 60 miles in length, or than 30 in breadth; notwithstanding which they supply the capital and all the neighbouring country with cattle, honey, butter, wax, hides, and a number of other necessary articles; whence it has been customary for the Abyssinian princes to exact a tribute rather than military service from them. The butter is kept from putrefaction during the long carriage, by mixing it with a small quantity of root somewhat like a carrot, which they call *mormoco*. It is of a yellow colour, and answers the purpose perfectly well; which in that climate it is very doubtful if salt could do. The latter is besides used as money; being circulated instead of silver coin, and used as change for gold. Brides paint their feet, hands, and nails, with this root. A large quantity of the seed of the plant was brought into Europe by Mr Bruce.

The Agows carry on a considerable trade with the Shangalla and other black savages in the neighbourhood; exchanging the produce of their country for gold, ivory, horns of the rhinoceros, and some fine cotton. The barbarity and thievish disposition of both nations, however, render this trade much inferior to what it might be.

In their religion the Agows are gross idolaters, paying divine honours to the Nile, as has already been observed. Mr Bruce, who lodged in the house of the priest of the river, had an opportunity of becoming acquainted with many particulars of their devotion. He heard him address a prayer to the Nile, in which he styled it the "Most High God, the Saviour of the world." In this prayer he petitioned for seasonable rain, plenty of grass, and the preservation of a kind of serpents; deprecating thunder very pathetically. The most sublime and lofty titles are given by them to the spirit which they suppose to reside in the river Nile; calling it everlasting God, Light of the World, Eye of the World, God of Peace, their Saviour, and Father of the Universe.

The Agows are all clothed in hides, which they manufacture in a manner peculiar to themselves. These hides are made in the form of a shirt, reaching down to their feet, and tied about the middle with a kind of sash or girdle. The lower part of it resembles a large double petticoat, one fold of which they turn back over their shoulders, fastening it with a broach or skewer across their breast before, and the married women carry their children in it behind. The younger sort generally go naked. The women are marriageable at nine years of age, though they commonly do not marry till eleven; and they continue to bear children till 30, and sometimes longer. They are generally thin and below the middle size, as well as the men. Barrenness is quite unknown among them.

The country of the Agows has a very elevated situation, and is of course so temperate that the heat may easily be borne, though little more than 10° from the equator. The people, however, are but short lived; which may in part be owing to the oppression they labour under. "Though their country (says Mr Bruce) abound with all the necessaries of life, their taxes, tributes, and services, especially at present, are so multiplied upon them, whilst their distresses of late have been so great and frequent, that they are only the manufacturers of the commodities they sell, to satisfy these constant exorbitant demands, and cannot enjoy any part of their own produce themselves, but live in penury and misery scarcely to be conceived. We saw a number of women wrinkled and sun-burnt so as scarcely to appear human, wandering about under a burning sun, with one and sometimes two children upon their backs; gathering the seeds of bent grass to make a kind of bread." As to the opinions respecting the identity of the Nile and the Niger, see AFRICA, SUPPLEMENT, p. 106.

NILOMETER, or NILOSCOPE, an instrument used among the ancients to measure the height of the water of the river Nile in its overflowings. The word comes from Νειλος, Nile (and that from *νεα ιλυς*, "new mud," or as some others would have it, from *νεω*, "I flow," and *ιλυς*, "mud,") and *μετρον*, "measure." The Greeks more ordinarily call it, Νειλοσκοπειον.

The nilometer is said, by several Arabian writers, to have been first set up, for this purpose, by Joseph during his regency in Egypt: the measure of it was 16 cubits, this being the height of the increase of the Nile, which was necessary to the fruitfulness of Egypt.

From the measure of this column, Dr Cumberland * deduces an argument, in order to prove that the Jewish and Egyptian cubits were of the same length.

In the French king's library is an Arabic treatise on nilometers, entitled *Neil fi alnal al Nil;* wherein are described all the overflowings of the Nile, from the first year of the Hegira to the 875th.

Herodotus mentions a column erected in a point of the island Delta, to serve as a nilometer; and there is still one of the same kind in a mosque of the same place.

As all the riches of Egypt arise from the inundations of the Nile, the inhabitants used to supplicate them at the hands of their Serapis; and committed the most execrable crimes, as actions, forsooth, of religion, to obtain the favour. This occasioned Constantine expressly

* *Scripture Weights and Measures*, p. 18.

Nilometer ‖ Nimeguen.

to prohibit these sacrifices, &c. and to order the nilometer to be removed into the church; whereas, till that time, it had been in the temple of Serapis. Julian the Apostate had it replaced in the temple, where it continued till the time of Theodosius the Great.

† Bruce's Travels, vol. iii.

The following is Mr Bruce's account of the nilometer. "On the point † of the island Rhode, between Geeza and Cairo, near the middle of the river, is a round tower enclosing a neat well or cistern lined with marble. The bottom of this well is on the same level with the bottom of the Nile, which has free access to it through a large opening like an embrasure. In the middle of the well rises a thin column of eight faces of blue and white marble; of which the foot is on the same plane with the bottom of the river. This pillar is divided into 20 peeks, of 22 inches each. Of these peeks the two lowermost are left, without any division, to stand for the quantity of sludge which the water deposits there. Two peeks are then divided, on the right hand, into 24 digits each; then on the left, four peeks are divided into 24 digits; then on the right, four: and on the left another four: again, four on the right, which completes the number of 18 peeks from the first division marked on the pillar, each peek being 22 inches. Thus the whole marked and unmarked amounts to something more than 36 feet English."

On the night of St John, when, by the falling of the dew, they perceive the rain water from Ethiopia mixed with the Nile at Cairo, they begin to announce the elevation of the river, having then five peeks of water marked on the nilometer, and two unmarked for the sludge, of which they take no notice. Their first proclamation, supposing the Nile to have risen 12 digits, is 12 from 6, or it wants 12 digits to be 6 peeks. When it has risen three more, it is nine from six; and so on, till the whole 18 be filled, when all the land of Egypt is fit for cultivation. Several canals are then opened, which convey the water into the desert, and hinder any further stagnation on the fields. There is indeed a great deal of more water to come from Ethiopia; but were the inundation suffered to go on, it would not drain soon enough to fit the land for tillage: and to guard against this mischief is the principal use of the nilometer, though the Turkish government makes it an engine of taxation. From time immemorial the Egyptians paid, as tribute to the king, a certain proportion of the fruit of the ground; and this was anciently ascertained by the elevation of the water on the nilometer, and by the mensuration of the land actually overflowed. But the Saracen government, and afterwards the Turkish, has taxed the people by the elevation alone of the water, without attending to its course over the country, or the extent of the land actually overflowed; and this tax is sometimes cruelly oppressive.

NIMBUS, in antiquity, a circle observed on certain medals, or round the heads of some emperors; answering to the circles of light drawn round the images of saints.

NIMEGUEN, a large, handsome, and strong town of the Netherlands, and capital of Dutch Guelderland, with a citadel, an ancient palace, and several forts. It is noted for a congress of most of the powers of Europe, who concluded a peace here in 1678. It has a magnificent townhouse, and the inhabitants are greatly given to trade. It is seated on the Vahal or Wahal, between the Rhine and the Maese. It contains two Dutch churches, a French Calvinist and a Lutheran church, five Popish, and several hospitals. It was once a Hans town and an imperial city. It was once the seat of government, has a canal to Arnheim, and considerable trade to some parts of Germany: it trades also in fine beer brewing, fattening of cattle, and exporting of its butter, which is extremely good, into all the other provinces. It was taken by the French in 1794. It is in E. Long. 5. 45. N. Lat. 51. 55.

Nimeguen ‖ Nimrod.

NIMETULAHITES, a kind of Turkish monks, so called from their founder Nimetulahi, famous for his doctrines and the austerity of his life.

NIMPO, a city and seaport town of China, in the province of Chekiang. It is seated on the eastern sea of China, over against Japan. It is a city of the first rank, and stands at the confluence of two small rivers, which, after their union, form a channel that reaches to the sea, and is deep enough to bear vessels of 200 tons burden. The walls of Nimpo are 5000 paces in circumference, and are built with freestone. There are five gates, besides two water gates for the passage of barks into the city; a tower several stories high, built of bricks; and a long bridge of boats, fastened together with iron chains, over a very broad canal. The city is commanded by a citadel built on a very high rock, by the foot of which all vessels must necessarily pass. The Chinese merchants of Siam and Batavia go to this place yearly to buy silks, which are the finest in the empire. They have also a great trade with Japan, it being but two days sail from hence: thither they carry silks, stuffs, sugar, drugs, and wine; and bring back copper, gold, and silver. E. Long. 122. 0. N. Lat. 30. 0.

NIMROD, the sixth son of Cush, and in all appearance much younger than any of his brothers: for Moses mentions the sons of Raamah, his fourth brother, before he speaks of him. What the sacred historian says of him is short; and yet he says more of him than of any other of the posterity of Noah, till he comes to Abraham. He tells us, that "Nimrod began to be a mighty one in the earth;" that he was "a mighty hunter before the Lord," even to a proverb; and that "the beginning of his kingdom was Babel, and Erech, and Accad, and Calneh, in the land of Shinar."

From this account he is supposed to have been a man of extraordinary strength and valour. Some represent him as a giant; all consider him as a great warrior. It is generally thought that by the words *a mighty hunter*, is to be understood, that he was a great tyrant; but some of the rabbins interpret those words favourably, saying that Nimrod was qualified by a peculiar dexterity and strength for the chase, and that he offered to God the game which he took; and several of the moderns are of opinion, that this passage is not to be understood of his tyrannical oppressions, or of hunting of men, but of beasts. It must be owned that the phrase *before the Lord* may be taken in a favourable sense, and as a commendation of a person's good qualities; but in this place the generality of expositors understand it otherwise.

Hunting must have been one of the most useful employments in the times just after the dispersion, when all countries were overrun with wild beasts, of which it was necessary they should be cleared, in order to make them habitable; and therefore nothing seemed more proper to procure a man esteem and honour in those

ages

Nimrod.

ages than his being an expert hunter. By that exercise, we are told, the ancient Persians fitted their kings for war and government; and hunting is still, in many countries, considered as one part of a royal education.

There is nothing in the short history of Nimrod which carries the least air of reproach, except his name, which signifies a *rebel;* and that is the circumstance which seems to have occasioned the injurious opinions which have been entertained of him in all ages. Commentators, being prepossessed in general that the curse of Noah fell upon the posterity of Ham, and finding this prince stigmatized by his name, have interpreted every passage relating to him to his disadvantage. They represent him as a rebel against God, in persuading the descendants of Noah to disobey the divine command to disperse, and in setting them to build the tower of Babel, with an impious design of scaling heaven. They brand him as an ambitious usurper, and an insolent oppressor; and make him the author of the adoration of fire, of idolatrous worship given to men, and the first persecutor on the score of religion. On the other hand, some account him a virtuous prince, who, far from advising the building of Babel, left the country, and went into Assyria, because he would not give his consent to that project.

Nimrod is generally thought to have been the first king after the flood; though some authors, supposing a plantation or dispersion prior to that of Babel, have made kings in several countries before his time. Mizraim is thought, by many who contend for the antiquity of the Egyptian monarchy, to have begun his reign much earlier than Nimrod; and others, from the uniformity of the languages spoken in Assyria, Babylonia, Syria, and Canaan, affirm those countries to have been peopled before the confusion of tongues.

The four cities Moses gives to Nimrod constituted a large kingdom in those early times, when few kings had more than one; only it must be observed, that possessions might at first have been large, and afterwards divided into several parcels; and Nimrod being the leader of a nation, we may suppose his subjects settled within those limits: whether he became possessed of those cities by conquest or otherwise, does not appear; it is most probable he did not build Babel, all the posterity of Noah seeming to have been equally concerned in that affair; nor does it appear that he built the other three, though the founding of them, and many more, with other works, are attributed to him by some authors. It may seem also a little strange, that Nimrod should be preferred to the regal dignity, and enjoy the most cultivated part of the earth then known, rather than any other of the elder chiefs or heads of nations, even of the branch of Ham. Perhaps it was conferred on him for his dexterity in hunting; or, it may be, he did not assume the title of king till after his father Cush's death, who might have been settled there before him, and left him the sovereignty; but we incline to think, that he seized Shinar from the descendants of Shem, driving out Ashur, who from thence went and founded Nineveh, and other cities in Assyria.

The Scripture does not inform us when Nimrod began his reign: Some date it before the dispersion; but such a conjecture does not seem to suit with the Mosaical history; for before the dispersion we read of no city but Babel; nor could there well be more, while all mankind were yet in a body together; but when Nimrod assumed the regal title, there seem to have been other cities; a circumstance which shows it was a good while after the dispersion. The learned writers of the Universal History place the beginning of his reign 30 years from that event, and in all likelihood it should be placed rather later than earlier.

Nimrod
||
Nineveh.

Authors have taken a great deal of pains to find Nimrod in profane history: some have imagined him to be the same with Belus, the founder of the Babylonish empire; others take him to be Ninus, the first Assyrian monarch. Some believe him to have been Evechous, the first Chaldean king after the deluge; and others perceive a great resemblance between him and Bacchus, both in actions and name. Some of the Mohammedan writers suppose Nimrod to have been Zohak, a Persian king of the first dynasty: others contend for his being Cay Caus, the second king of the second race; and some of the Jews say he is the same with Amraphel the king of Shinar, mentioned by Moses. But there is no certainty in these conjectures, nor have we any knowledge of his immediate successors.

The Scripture mentions nothing as to the death of Nimrod; but authors have taken care that such an essential circumstance in his history should not be wanting. Some of the rabbins pretend he was slain by Esau, whom they make his contemporary. There is a tradition that he was killed by the fall of the tower of Babel, which was overthrown by tempestuous winds. Others say, that as he led an army against Abraham, God sent a squadron of gnats, which destroyed most of them, and particularly Nimrod, whose brain was pierced by one of those insects.

NINE, the last of the radical numbers or characters; from the combination of which any definite number, however large, may be produced. "It is observed by arithmeticians (says Hume), that the products of 9 compose always either 9 or some lesser products of 9, if you add together all the characters of which any of the former products is composed: thus of 18, 27, 36, which are products of 9, you make 9, by adding 1 to 8, 2 to 7, 3 to 6. Thus 369 is a product also of 9; and if you add 3, 6, and 9, you make 18, a lesser product of 9." See *Hume's Dialogues on Nat. Relig.* p. 167, 168, &c. 2d. edit.

NINEVEH, in *Ancient Geography*, the capital city of Assyria, founded by Ashur the son of Shem (Gen. x. 11.); or, as others read the text, by Nimrod the son of Cush.

However this be, yet it must be owned, that Nineveh was one of the most ancient, the most famous, the most potent, and largest cities of the world. It is very difficult exactly to assign the time of its foundation; but it cannot be long after the building of Babel. It was situated upon the banks of the Tigris; and in the time of the prophet Jonas, who was sent thither under Jeroboam II. king of Israel, and, as Calmet thinks, under the reign of Pul, father of Sardanapalus, king of Assyria, Nineveh was a very great city, its circuit being three days journey (Jonah iii. 3.). Diodorus Siculus, who has given us the dimensions of it, says it was 480 stadia in circumference, or 47 miles; and that it was surrounded with lofty walls and towers; the former being 200 feet in height, and so very broad that three chariots might drive on them abreast; and the latter 200 feet in height, and 1500 in number; and Strabo allows it to have been

much

much greater than Babylon. Diodorus Siculus was, however, certainly mistaken, or rather his transcribers, as the authors of the Universal History think, in placing Nineveh on the Euphrates, since all historians as well as geographers who speak of that city, tell us in express terms that it stood on the Tigris. At the time of Jonah's mission thither, it was so populous, that it was reckoned to contain more than six score thousand persons, who could not distinguish their right hand from their left (Jonah iv. 11.), which is generally explained of young children that had not yet attained to the use of reason; so that upon this principle it is computed that the inhabitants of Nineveh were then above 600,000 persons.

Nineveh was taken by Arbaces and Belesis, in the year of the world 3257, under the reign of Sardanapalus, in the time of Ahaz king of Judah, and about the time of the foundation of Rome. It was taken a second time by Astyages and Nabopolassar from Chynaladanus king of Assyria in the year 3378. After this time, Nineveh no more recovered its former splendour. It was so entirely ruined in the time of Lucianus Samosatensis, who lived under the emperor Adrian, that no footsteps of it could be found, nor so much as the place where it stood. However, it was rebuilt under the Persians, and destroyed again by the Saracens about the seventh age.

Modern travellers say (A), that the ruins of ancient Nineveh may still be seen on the eastern banks of the Tigris, opposite to the city of Mosul or Mousul: (See MOUSUL). Profane historians tell us, that Ninus first founded Nineveh; but the Scripture assures us, that it was Ashur or Nimrod.

The sacred authors make frequent mention of this city; and Nahum and Zephaniah foretold its ruin in a very particular and pathetic manner.

NINIA, or NINIAN, commonly called *St Ninian*, a holy man among the ancient Britons. He resided at or near a place called by Ptolemy *Leucopibia*, and by Bede *Candida Casa:* but the English and Scotch called it *Whithorne*. We mention him, because he is said to have been the first who converted the Scots and Picts to the Christian faith; which he did during the reign of Theodosius the Younger. Bede informs us, that he built a church dedicated to St Martin, in a style unknown to the Britons of that time; and adds, that during his time the Saxons held this province (*Gallovidia*, now *Galloway*), and that, as in consequence of the labours of this saint the converts to Christianity increased, an episcopal see was established there. Dr Henry, considering that "few or none of the writings of the most ancient fathers of the British church are now extant, and since little being said of them by their cotemporaries, we can know little of their personal history and of the extent of their erudition," gives a short account of some of them. Of St Ninian he says, "he was a Briton of noble birth and excellent genius. After he had received as good an education at home as his own country could afford, he travelled for his further improvement, and spent several years at Rome, which was then the chief seat of learning as well as of empire. From thence he returned into Britain, and spent his life in preaching the gospel in the most uncultivated parts of it, with equal zeal and success."

There is a small town called *St Ninian*, about a mile south of Stirling. Its church had been occupied by the rebels in 1745 as a powder magazine; who on their return blew it up in such haste, as to destroy some of their own people and about fifteen spectators.

NING-PO-FOU, called by the Europeans *Liampo*, is an excellent port, on the eastern coast of China, opposite to Japan. Eighteen or twenty leagues from this place is an island called *Tcheou-chan*, where the English first landed on their arrival at China.

The silks manufactured at Ning-po are much esteemed in foreign countries, especially in Japan, where the Chinese exchange them for copper, gold, and silver. This city has four others under its jurisdiction, besides a great number of fortresses.

NINON L'ENCLOS, a celebrated lady in the court of France, was of a noble family, and born at Paris in the year 1615; but rendered herself famous by her wit and gallantries. Her mother was a lady of exemplary piety; but her father early inspired her with the love of pleasure. Having lost her parents at 14 years of age, and finding herself mistress of her own actions, she resolved never to marry: she had an income of 10,000 livres a-year; and, according to the lessons she had received from her father, drew up a plan of life and gallantry, which she pursued till her death. Never delicate with respect to the number, but always in the choice, of her pleasures, she sacrificed nothing to interest; but loved only while her taste for it continued; and had among her admirers the greatest lords of the court. But notwithstanding the levity of her conduct, she had many virtues.—She was constant in her friendship, faithful to what are called the *laws of honour*, of strict veracity, disinterested, and more particularly remarkable for perfect probity. Women of the most respectable characters were proud of the honour of having her for their friend; at her house was an assemblage

(A) This assertion, however, is far from seeming probable; for every trace of it seems to have so totally disappeared, even so early as A. D. 627, that the vacant space afforded a spacious field for the celebrated battle between the emperor Heraclius and the Persians. There are few things in ancient history which have more puzzled the learned world, than to determine the spot where this city stood. Mr Ives informs us, that some have imagined it stood near Jonah's tomb; others, however, place it at another place, some hours journey up the Tigris. These different opinions, however, seem perfectly reconcileable; for it appears at least probable, that ancient Nineveh took in the whole of the ground which lies between these two ruined places. Mr Ives adds, that "what confirms this conjecture is, that much of this ground is now hilly, owing no doubt to the rubbish of the ancient buildings. There is one mount of 200 or 300 yards square, which stands some yards north-east of Jonah's tomb, whereon it is likely a fortification once stood. It seems to have been made by nature, or perhaps both by nature and art, for such an use."

semblage of every thing most agreeable in the city and the court; and mothers were extremely desirous of sending their sons to that school of politeness and good taste, that they might learn sentiments of honour and probity, and those other virtues, that render men amiable in society. But the illustrious Madame de Sevigné with great justice remarks in her letters, that this school was dangerous to religion and the Christian virtues; because Ninon L'Enclos made use of seducing maxims, capable of depriving the mind of those invaluable treasures. Ninon was esteemed beautiful even in old age; and is said to have inspired violent passions at 80. She died at Paris in 1705. This lady had several children; one of whom, named *Chevalier de Villiers*, excited much attention by the tragical manner in which he ended his life. He became in love with Ninon, without knowing that she was his mother; and when he discovered the secret of his birth, stabbed himself in a fit of despair. There have been published the pretended letters of Ninon L'Enclos to the Marquis de Sevigné.

NINTH, in *Music*. See INTERVAL.

NINUS, the first king of the Assyrians, was, it is said, the son of Belus. It is added, that he enlarged Nineveh and Babylon; conquered Zoroaster king of the Bactrians; married Semiramis of Ascalon; subdued almost all Asia; and died after a glorious reign of 52 years, about 1150 B. C.; but all these facts are uncertain. See SEMIRAMIS.

NIO, an island of the Archipelago, between Naxi to the north, Armago to the east, Santerino to the south, and Sikino to the west, and is about 35 miles in circumference. It is remarkable for nothing but Homer's tomb, which they pretend is in this island; for they affirm that he died here in his passage from Samos to Athens. The island is well cultivated, and not so steep as the other islands, and the wheat which it produces is excellent; but oil and wood are scarce. It is subject to the Turks. E. Long. 25. 35. N. Lat. 36. 43.

NIOBE, in fabulous history, according to the fictions of the poets, was the daughter of Tantalus, and wife of Amphion king of Thebes; by whom she had seven sons and as many daughters. Having become so proud of her fertility and high birth, as to prefer herself before Latona, and to slight the sacrifices offered up by the Theban matrons to that goddess, Apollo and Diana, the children of Latona, resented this contempt. The former slew the male children and the latter the female; upon which Niobe was struck dumb with grief, and remained without sensation. Cicero is of opinion, that on this account the poets feigned her to be turned into stone.

The story of Niobe is beautifully related in the sixth book of the Metamorphoses of Ovid. That poet thus describes her transformation into stone.

Widow'd and childless, lamentable state!
A doleful sight, among the dead she sat;
Harden'd with woes, a statue of despair,
To ev'ry breath of wind unmov'd her hair;
Her cheek still redd'ning, but its colour dead,
Fadded her eyes, and set within her head.
No more her pliant tongue its motion keeps,
But stands congeal'd within her frozen lips.
Stagnate and dull, within her purple veins,
Its current stopp'd, the lifeless blood remains.
Her feet the usual offices refuse,
Her arms and neck their graceful gestures lose:
Action and life from ev'ry part are gone,
And ev'n her entrails turn to solid stone.
Yet still she weeps; and whirl'd by stormy winds,
Borne thro' the air, her native country finds;
There fixed, she stands upon a bleaky hill;
There yet her marble cheeks eternal tears distil.

Niobe in this statue is represented as in an ecstacy of grief for the loss of her offspring, and about to be converted into stone herself. She appears as if deprived of all sensation by the excess of her sorrow, and incapable either of shedding tears or of uttering any lamentations, as has been remarked by Cicero in the third book of his Tusculan Questions. With her right hand she clasps one of her little daughters, who throws herself into her bosom; which attitude equally shows the ardent affection of the mother, and expresses that natural confidence which children have in the protection of a parent. The whole is executed in such a wonderful manner, that this with the other statues of her children, is reckoned by Pliny among the most beautiful works of antiquity: but he doubts to whom of the Grecian artists he ought to ascribe the honour of them (A). We have no certain information at what period this celebrated work was transported from Greece to Rome, nor do we know where it was first erected. Flaminius Vacca only says, that all these statues were found in his time not far from the gate of St John, and that they were afterwards placed by the grand duke Ferdinand in the gardens of the Villa de Medici near Rome.—An ingenious and entertaining traveller (Dr Moore), speaking of the statue of Niobe, says, "The author of Niobe has had the judgment not to exhibit all the distress which he might have placed in her countenance. This consumate artist was afraid of disturbing her features too much, knowing full well that the point where he was to expect most sympathy was there, where distress co-operated with beauty, and where *our pity met our love*. Had he sought it one step farther in *expression*, he had lost it."

In the following epigram this statue is ascribed to Praxiteles:

Εκ ζωης με Θεοι τευξαν λιθον. Εκ δε λιθοιο
Ζωην Πραξιτελης εμπαλιν ειργασατο.

While for my children's fate I vainly mourn'd,
The angry gods to massy stone me turn'd;
Praxiteles a nobler feat has done,
He made me live again from being stone.

The author of this epigram, which is to be found in the 4th book of the *Anthology*, is unknown. Scaliger the father, in his *Farrago Epigrammatum*, p. 172. ascribes it to Callimachus, but this appears to be only conjecture. Cœlius

(A) Par hæsitatio in templo Apollinis Sosiani, Nioben cum liberis morientem, Scopas an Praxiteles fecerit.

Cælius Calcagninus has made a happy translation of it into Latin.

Vivam olim in lapidem verterunt numina; sed me
Praxiteles vivam reddidit ex lapide.

And perhaps the following French version of it will appear no less happy:

De vive que j'étois, les Dieux
M'ont changée en pierre massive:
Praxitele a fait beaucoup mieux,
De pierre il m'a scû rendre vive.

NIPHON, the largest of the Japan islands, being 800 miles long and 100 broad. See JAPAN.

NIPPERS, in the manege, are four teeth in the fore part of a horse's mouth, two in the upper, and two in the lower jaw. A horse puts them forth between the second and third year.

NIPPLES, in *Anatomy*. See MAMMÆ, ANATOMY *Index*.

NIPPLE-WORT. See LAPSANA, BOTANY *Index*.

NISAN, a month of the Hebrews, answering to our March, and which sometimes takes from February or April, according to the course of the moon. It was the first month of the sacred year, at the coming out of Egypt (Exod. xii. 2), and it was the seventh month of the civil year. By Moses it is called Abib. The name Nisan is only since the time of Ezra, and the return from the captivity of Babylon.

On the first day of this month the Jews fasted for the death of the children of Aaron (Lev. x. 1, 2, 3.). On the tenth day was celebrated a fast for the death of Miriam the sister of Moses; and every one provided himself with a lamb for the passover. On this day the Israelites passed over Jordan under the conduct of Joshua (iv. 19.). On the fourteenth day in the evening they sacrificed the pascal lamb; and the day following, being the fifteenth, was held the solemn passover (Exod. xii. 18. &c.). The sixteenth they offered the sheaf of the ears of barley as the first fruits of the harvest of that year (Levit. xxiii. 9. &c.). The twenty-first was the octave of the passover, which was solemnized with particular ceremonies. The twenty-sixth the Jews fasted in memory of the death of Joshua. On this day they began their prayers to obtain the rains of the spring. On the twenty-ninth they called to mind the fall of the walls of Jericho.

NISI PRIUS, in *Law*, a judicial writ which lies in cases where the jury being impannelled and returned before the justices of the bank, one of the parties requests to have such a writ for the ease of the country, in order that the trial may come before the justices in the same county on their coming thither. The purport of a writ of *nisi prius* is, that the sheriff is thereby commanded to bring to Westminster the men impannelled, at a certain day, before the justices, "*nisi prius justiciarii domini regis ad assisas capiendas venerint.*"

NISIBIS, in *Ancient Geography*, a city both very ancient, very noble, and of very considerable strength, situated in a district called *Mygdonia*, in the north of Mesopotamia, towards the Tigris, from which it is distant two days journey. Some ascribe its origin to Nimrod, and suppose it to be the *Achad* of Moses. The Macedonians call it *Antiochia of Mygdonia* (Plutarch); situated at the foot of Mount Masius (Strabo). It was the Roman bulwark against the Parthians and Persians. It sustained three memorable sieges against the power of Sapor, A. D. 338, 346, and 350; but the emperor Jovianus, by an ignominious peace, delivered it up to the Persians, A. D. 363.——A colony called *Septimia Nisibitana.*——Another *Nisibis*, of Aria, (Ptolemy) near the lake Arias.

Mr Ives, who passed through this place in 1758, tells us, that "it looked pretty at a distance, being seated on a considerable eminence, at the foot of which runs a river, formerly called the *Mygdonius*, with a stone bridge of eleven arches built over it. Just by the river, at the foot of the hill, or hills (for the town is seated on two), begin the ruins of a once more flourishing place, which reach quite up to the present town. From every part of this place the most delightful prospects would appear, were the soil but properly cultivated and planted; but instead of those extensive woods of fruit trees, which Rawolf speaks of as growing near the town, not above thirty or forty straggling trees of any kind can be perceived; and instead of that great extent of arable land on which he dwells so much, a very inconsiderable number of acres are now remaining. The town itself is despicable, and streets extremely narrow, and the houses, even those which are of stone, are mean. It suffered grievously by the famine of 1757, losing almost all its inhabitants either by death or desertion. The streets presented many miserable objects, who greedily devoured rinds of cucumbers, and every other refuse article of food thrown out into the highway. Here the price of bread had risen near 4000 per cent. within the last 14 years.

NISMES, an ancient, large, and flourishing town of France, in the department of Garde, with a bishop's see, and an academy. The manufactures of cloth both of gold and silk, and of stuffs formerly known by the name of serge of Nismes, exceed that of all the rest of the province. There are several monuments of antiquity, of which the amphitheatre is the principal built by the Romans. The *maison quarrée*, or the square house, is a piece of architecture of the Corinthian order, and one of the finest in the world. The temple of Diana is in part gone to ruin. It was taken by the English in 1417. The inhabitants were chiefly Calvinists; but Louis XIV. demolished their church in 1685, and built a castle to keep them in awe. It is seated in a delightful plain, abounding in wine, oil, game and cattle. It contains a great number of venerable relicks of Roman antiquity and grandeur, which it is not our business to describe, though it is chiefly remarkable for these and its delightful situation. Its population in 1800 was 39,300, of whom about 10,000 are Protestants. After the second return of Louis XVIII. in 1815, Nismes was the scene of some disgraceful outrages. The Protestants had been friendly to the Revolution, though they took no part in its atrocities; but the Catholics made this a pretext for treating them as rebels. In the city alone nearly 300 of the Protestants were murdered, and in the neighbouring districts as many more as made a total of 2000: a great number were obliged to fly; 2000 ransomed their lives by sums of money, and 150 houses were pillaged or burnt within the town. Money was collected for the relief of the sufferers in London, Edinburgh, and other towns in Britain. E. Long. 4. 26. N. Lat. 43. 51.

NISROCH, a god of the Assyrians. Sennacherib was killed by two of his sons while he was paying his adoration to his god Nisroch in his temple (2 King xix. 37.). It is not known who this god Nisroch was. The Septuagint calls him Mesrach, Josephus calls him Araskes. The Hebrew of Tobit published by Munster calls him Dagon. The Jews have a strange notion concerning this deity, and fancy him to have been a plank of Noah's ark. Some think the word signifies a dove; and others understand by it an eagle, which has given occasion to an opinion, that Jupiter Belus, from whom the Assyrian kings pretended to be derived, was worshipped by them under the form of an eagle, and called Nisroch. Our poet Milton gives this name to one of the rebel angels.

——In the assembly next up stood
Nisroch, of principalities the prince.
Par. Lost, book vi. 447.

NISSOLIA, a genus of plants belonging to the diadelphia class, and in the natural method ranking under the 32d order, *Papilionaceæ*. See BOTANY *Index*.

NITHSDALE, NITHISDALE, or *Niddisdale*, a district of Dumfriesshire in Scotland, lying to the westward of Annandale. It is a large and mountainous tract, deriving its name from the river Nid, or Nith, which rises on the borders of Ayrshire, and running by Sanquhar and Dumfries, discharges itself into the Solway frith. This country was formerly shaded with noble forests, which are now almost destroyed; so that at present, nothing can be more naked, wild, and savage. Yet the bowels of the earth yield lead, and, as is said, silver and gold: the mountains are covered with sheep and black cattle; and here are still some considerable remains of the ancient woods, particularly that of Holywood, three miles from Dumfries, noted for a handsome church, built out of the ruins of an ancient abbey; and also for being the birthplace of the famous astrologer, hence called *Joannes de Sacro Bosco*. Mr Pennant calls it a beautiful vale, improved in appearance by the bold curvatures of the meandering stream, and for some space, he says, it is adorned with groves and gentlemen's seats.

NITOCRIS, the mother of Belshazzar (whose father was Evil Merodach and his grandfather Nebuchadnezzar), was a woman of extraordinary abilities; she took the burden of all public affairs upon herself; and, while her son followed his pleasures, did all that could be done by human prudence to sustain the tottering empire. She perfected the works which Nebuchadnezzar had begun for the defence of Babylon; raised strong fortifications on the side of the river, and caused a wonderful vault to be made under it, leading from the old palace to the new, 12 feet high and 15 wide. She likewise built a bridge across the Euphrates, and accomplished several other works, which were afterwards ascribed to Nebuchadnezzar. Philostrates, in describing this bridge, tells us, that it was built by a queen, who was a native of Media; whence we may conclude this illustrious queen to have been by birth a Mede. Nitocris is said to have placed her tomb over one of the most remarkable gates of the city, with an inscription to the following effect:

If any king of Babylon after me shall be in distress for money, he may open this sepulchre, and take out as much as may serve him; but if he be in no real necessity, let him forbear, or he shall have cause to repent of his presumption.

This monument and inscription are said to have remained untouched till the reign of Darius, who, considering the gate was useless, no man caring to pass under a dead body, and being invited by the hopes of an immense treasure, broke it open; but, instead of what he sought, is said to have found nothing but a corpse; and another inscription, to the following effect:

Hadst thou not been most insatiably avaricious and greedy of the most sordid gain, thou wouldst never have violated the abode of the dead.

NITHRARIA, a genus of plants belonging to the dodecandria class, and in the natural method ranking with those of which the order is doubtful. See BOTANY *Index*.

NITRE, SALTPETRE, or *Nitrate of Potash*. See CHEMISTRY, N° 938, *et seq*.

Calcareous NITRE. See LIME, *Nitrate of*, CHEMISTRY *Index*.

NITROUS, any thing impregnated with nitrous air.

Nitrous Air. See AZOTE, CHEMISTRY *Index*.

NIVELLE, a town in the Netherlands, in the province of Brabant, remarkable for its abbey of canonesses. Here is a manufacture of cambrics, and the town enjoys great privileges. The abbey just mentioned is inhabited by young ladies of the first quality, who are not confined therein as in nunneries, but may go out and marry whenever they see convenient, or a proper match offers. It contained 6537 inhabitants in 1800. E. Long. 4. 36. N. Lat. 50. 35.

NIVELLE *de la Chaussée* (Peter Claude), a comic poet, born in Paris; acquired great reputation by inventing a new kind of entertainment, which was called the *Weeping Comedy*. Instead of imitating Aristophanes, Terence, Moliere, and the other celebrated comic poets who had preceded him; and instead of exciting laughter by painting the different ridiculous characters, giving strokes of humour and absurdities in conduct; he applied himself to represent the weaknesses of the heart, and to touch and soften it. In this manner he wrote five comedies: 1. *La fausse Antipathie*. 2. *Le prejugé à la Mode*; this piece met with great success. 3. *Melanide*. 4. *Amour pour Amour*; and, 5. *L'Ecole des Meres*. He was received into the French academy in 1736; and died at Paris in 1754, at 63 years of age. He also wrote a tragedy, entitled, *Maximianus*; and an epistle to Clio, an ingenious didactic poem.

NIVERNOIS, an inland province of France, with the title of a *duchy*, lying on the west side of Burgundy, and between it, Bourbonnois, and Barri. It is pretty fertile in wine, fruit, and corn; except the part called *Morvant*, which is a mountainous country, and barren. There is a great deal of wood, and several iron mines; as also mines of pit coal, which serves to work their forges. This province is watered by a great number of rivers; of which the Allier, the Loire, and the Yonne, are navigable. It now forms the department of Nevers, which is also the name of the capital city.

Niwegal ‖ Noah.

NIWEGAL, a village lying on the coast in Pembrokeshire, South Wales, remarkably only for the discovery of an immense quantity of the stumps of trees appearing below low water mark, after and during a storm in the year 1590, notwithstanding the country all round is now entirely barren of wood.

NIXAPA, a rich and considerable town in New Spain, with a rich convent of Dominicans. The country about it abounds in cochineal, indigo, and sugar. E. Long. 97. 15. N. Lat. 16. 42.

NIZAM (says Gibbon, one of the most illustrious ministers of the east, was honoured by the caliph as an oracle of religion and science; he was trusted by the sultan as the faithful vicegerent of his power and justice. After an administration of 30 years, the fame of the vizier, his wealth, and even his services, were transformed into crimes. He was overthrown by the insidious arts of a woman and a rival; and his fall was hastened by a rash declaration, that his cap and ink horn, the badges of his office, were connected by the divine decree with the throne and diadem of the sultan. At the age of 93 years, the venerable statesman was dismissed by his master, accused by his enemies, and murdered by a fanatic: the last words of Nizam attested his innocence, and the remainder of Malek's life was short and inglorious.

NO, (Jeremiah, Ezekiel), NO-AMMON, (Nahum); a considerable city of Egypt, thought to be the name of an idol which agrees with Jupiter Ammon. The Septuagint translate the name in Ezekiel, *Diospolis*, "the city of Jupiter." Bochart takes it to be *Thebes* of Egypt; which, according to Strabo and Ptolemy, was called *Diospolis*. Jerome, after the Chaldee paraphrast Jonathan, supposes it to be Alexandria, named by way of anticipation; or an ancient city of that name is supposed to have stood on the spot where Alexandria was built.

No-Man's-Land, a space between the after part of the belfrey and the fore part of a ship's boat, when the said boat is stowed upon the booms, as in a deep waisted vessel. These booms are laid from the forecastle nearly to the quarter-deck, where their after ends are usually sustained by a frame called the *gallows*, which consists of two strong posts, about six feet high, with a cross piece reaching from one to the other, athwart ships, and serving to support the ends of those booms, masts, and yards, which lie in reserve to supply the place of others carried away, &c. The space called *No-Man's-Land* is used to contain any blocks, ropes, tackles, &c. which may be necessary on the forecastle. It probably derives this name from its situation, as being neither on the starboard nor larboard side of the ship, nor on the waste or forecastle; but, being situated in the middle, partakes equally of all those places.

NOAH, or NOE, the son of Lamech, was born in the year of the world 1056. Amidst the general corruption into which all mankind were fallen at this time, Noah alone was found to be just and perfect in his generation, walking with God (Gen. vi. 9.). This extraordinary person having therefore found favour in the eyes of the Lord, and God seeing that all flesh had corrupted their ways, told Noah, that he was resolved to destroy mankind from the face of the earth by a flood of waters; and not them alone, but all the beasts of the earth, and every creeping thing, as well as the fowls of the air (*Id. ib.* 7.). The Lord therefore directed Noah, as a means of preserving him and his family (for he had three sons, Shem, Ham, and Japheth, who were all married before the flood), to build an ark or vessel of a certain form and size fitted to that end, and which might besides accommodate such numbers of animals of all sorts, that were liable to perish in the flood, as would be sufficient to preserve the several species, and again replenish the earth; together with all necessary provisions for them; all which Noah performed, as may be seen more particularly under the article ARK.

Noah.

In the year of the world 1656, and the 600th year of his age, Noah, by God's appointment, entered the ark, together with his wife, his three sons, their wives, and all the animals which God caused to come to Noah; and being all entered, and the door of the ark being shut upon the outside, the waters of the deluge began to fall upon the earth, and increased in such a manner, that they were fifteen cubits above the tops of the highest mountains, and continued thus upon the earth for 150 days; so that whatever had life upon the earth, or in the air, was destroyed, except such as were with Noah in the ark. But the Lord remembering Noah, sent a wind upon the earth, which caused the waters to subside; so that upon the seventeenth day of the seventh month the ark rested on the mountains of Ararat; and Noah having uncovered the roof of the ark, and observing the earth was dry, he received orders from the Lord to come out of it, with all the animals that were therein; and this he did in the six hundred and first year of his age, on the 27th day of the second month. But the history of the deluge is more circumstantially related already under the article DELUGE.

Then he offered as a burnt sacrifice to the Lord one of all the pure animals that were in the ark; and the Lord accepted his sacrifice, and said to him that he would no more pour out his curse upon the whole earth, nor any more destroy all the animals as he had now done. He gave Noah power over all the brute creation, and permitted him to eat of them, as of the herbs and fruits of the earth: except only the blood, the use of which God did not allow them. He bid him increase and multiply, made a covenant with him, and God engaged himself to send no more an universal deluge upon the earth; and as a memorial of his promise, he set his bow in the clouds, to be as a pledge of the covenant he made with Noah (Gen. ix.).

Noah, being an husbandman, began now to cultivate the vine; and having made wine and drank thereof, he unwarily made himself drunk, and fell asleep in his tent, and happened to uncover himself in an indecent posture. Ham, the father of Canaan, having observed him in this condition, made himself sport with him, and acquainted his two brothers with it, who were without. But they, instead of making it a matter of sport, turned away from it, and going backwards they covered their father's nakedness, by throwing a mantle over him. Noah awaking, and knowing what Ham had done, said, that Canaan the son of Ham should be accursed, that he should be a slave of slaves in respect of his brethren. It is thought he had a mind to spare the person of his son Ham, for fear the curse might light

upon

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upon the other children of Ham, who had no part in this action. He cursed Canaan by a spirit of prophecy, because the Canaanites his descendants were after this to be rooted out by the Israelites. Noah added, Let the Lord, the God of Shem, be blessed, and let Canaan be the servant of Shem. And he was so in effect, in the person of the Canaanites subdued by the Hebrews. Lastly, Noah said, Let God extend the possession of Japheth; let Japheth dwell in the tents of Shem, and let Canaan be his servant. This prophecy had its accomplishment, when the Grecians, and afterwards the Romans, being descended from Japheth, made a conquest of Asia, which was the portion of Shem.

But Noah lived yet after the deluge three hundred and fifty years; and the whole time of his life having been nine hundred and fifty years, he died in the year of the world 2006. He left three sons, Shem, Ham, and Japheth, of whom mention is made under their several names; and, according to the common opinion, he divided the whole world amongst them, in order to repeople it. To Shem he gave Asia, to Ham Africa, and Europe to Japheth. Some will have it, that besides these three sons he had several others. The spurious Berosus gives him thirty, called Titans, from the name of their mother Titæa. They pretend that the Teutons or Germans are derived from a son of Noah called Thuiscon. The false Methodius also makes mention of Jonithus or Jonicus, a pretended son of Noah.

St Peter calls Noah a preacher of righteousness (2 Peter ii. 5.), because before the deluge he was incessantly preaching and declaring to men, not only by his discourses, but by his unblameable life, and by the building of the ark, in which he was employed six score years, that the wrath of God was ready to pour upon them. But his preaching had no effect, since when the deluge came, it found mankind plunged in their former enormities (Matt. xxiv. 37.).

Several learned men have observed, that the Heathens confounded Saturn, Deucalion, Ogyges, the god Cœlus or Uranus, Janus, Proteus, Prometheus, &c. with Noah. The wife of Noah is called Noriah by the Gnostics; and the fable of Deucalion and his wife Pyrrha is manifestly invented from the history of Noah.

The Rabbins pretend, that God gave Noah and his sons (all who are not of the chosen race of Abraham they call Noachidæ) certain general precepts, which contain, according to them, the natural right which is common to all men indifferently, and the observation of which alone will be sufficient to save them. After the law of Moses, the Hebrews would not suffer any stranger to dwell in their country, unless he would conform to the precepts of the Noachidæ. In war they put to death, without quarter, all that were ignorant of them. These precepts are seven in number.

The *first* directs, that obedience be paid to judges, magistrates, and princes.

By the *second*, the worship of false gods, superstition, and sacrilege, are absolutely forbidden.

The *third* forbids cursing the name of God, blasphemies, and false oaths.

The *fourth* forbids all incestuous and unlawful conjunctions, as sodomy, bestiality, and crimes against nature.

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The *fifth* forbids the effusion of blood of all sorts of animals, murder, wounds, and mutilations.

The *sixth* forbids thefts, cheats, lying, &c.

The *seventh* forbids to eat the parts of an animal still alive, as was practised by some Pagans.

To these the Rabbins have added some others; but what inclines us to doubt the antiquity of these precepts is, that no mention is made of them in Scripture, or in the writings of Josephus or Philo; and that none of the ancient fathers knew any thing of them.

NOB, a sacerdotal city of the tribe of Benjamin or Ephraim. St Jerome says, that in his time it was entirely destroyed, and that the ruins of it might be seen not far from Diospolis. When David was driven away by Saul, he went to Nob, and asking the high priest Ahimelech for some provisions and arms, the priest gave him the shew bread which had been lately taken off the holy table, and the sword of Goliath. Saul being informed of this by Doeg, caused all the priests of Nob to be slain, and the city to be destroyed, 1 Sam. xxi. xxii.

NOBAH, a city beyond Jordan. It took the name of Nobah from an Israelite of this name who had made a conquest of it, (Numb. xxxii. 42.). Gideon pursued the Midianites as far as this city, (Judg. viii. 2.) Eusebius says, that there is a desolate place of this name about eight miles from Heshbon towards the south. But this could not be the Nobah now mentioned, because it was much farther to the north.

NOBILIARY, in literary history, a book containing the history of the noble families of a nation or province: such are Choriere's Nobiliary of Dauphiné, and Caumartin's Nobiliary of Provence. The Germans are said to be particularly careful of their Nobiliaries, in order to keep up the dignity of their families.

NOBILITY, in general, signifies dignity, grandeur, or greatness; more particularly, it signifies antiquity of family, joined with riches: in the common acceptation of the word, it means that quality or dignity which raises a man above the rank of a peasant or a commoner.

At a time when the public mind is so much agitated on this subject, or subjects nearly allied to it, perhaps the less that is said on it the better. We should therefore (as far as concerns the question about its expediency in civil life, or the contrary) most cheerfully pass it over in silence, did we not esteem it our duty to give our readers at least some idea of it, and were it not our business to lay before them a few of those arguments which of late have been so copiously retailed both for and against this illustrious order of civil society: leaving them, however, that liberty which every man unquestionably ought to be allowed, of judging for themselves as they shall see most proper.

Whether that equality of rank and condition which has of late been so loudly contended for would be more agreeable to the order of nature, or more conducive to the happiness and prosperity of mankind, may indeed be made a question; but it is a question, we apprehend, which cannot receive different answers from men capable of reflecting without prejudice and partiality. A state of perfect equality can subsist only among

among beings possessing equal talents and equal virtues; but such beings are not men. Were all mankind under the constant influence of the laws of virtue, a distinction of ranks would be unnecessary; but in that case civil government itself would likewise be unnecessary, because men would have attained all that perfection to which it is the object of civil government as well as of religion to guide them: every man then would be a law unto himself. But whilst, in so many breasts, the selfish passions predominate over those which are social, violence must be restrained by authority; and there can be no authority without a distinction of ranks, such as may influence the public opinion.

It is well observed by Hume, that government is founded only on opinion; and that this opinion is of two kinds, opinion of interest, and opinion of right. When a people are persuaded that it is their interest to support the government under which they live, that government must be very stable. But among the worthless and unthinking part of the community, this persuasion has seldom place. All men, however, have a notion of rights—of a right to property and a right to power: and when the majority of a nation considers a certain order of men as having a right to that eminence in which they are placed, this opinion, call it prejudice or what we will, contributes much to the peace and happiness of civil society. There are many, however, who think otherwise, and imagine that "the society in which the greatest equality prevails must always be the most secure. These men conceive it to be the business of a good government to distribute as equally as possible those blessings which bounteous nature offers to all." It may readily be allowed that this reasoning is conclusive; but the great question returns, "How *far* can equality prevail in a society which is secure? and what is *possible* to be done in the equal distribution of the blessings of nature?" Till these questions be answered, we gain nothing by declaiming on the rights and equality of men; and the answers which have sometimes been given to them suppose a degree of perfection in human nature, which, if it were real, would make all civil institutions useless, as well as the reveries of those reformers. The conduct of the democratic states of Pagan antiquity, together with the oppressive anarchy and shameful violences which we have seen and still see in a neighbouring kingdom, will be considered by many as a full and satisfactory answer, deduced from experience, to all the schemes of the visionary theorist: such facts at least render the abolition of the order of nobility a matter of more importance, and of infinitely greater difficulty, than those who plead for it are disposed to allow.

It is an opinion not uncommon, and at least plausible, that the nobility of a well regulated state is the best security against monarchical despotism or lawless usurpation on the one hand, and the confusion of democratic insolence on the other. Self interest is the most powerful principle in the human breast; and it is obviously the interest of such men to preserve that balance of power in society upon which the very existence of their order depends. Corrupted as the present age confessedly is, a very recent instance could be given, in which the British House of Peers rescued at once the sovereign and the people from the threatened tyranny of a factious junto. As it is our business, however, to exhibit all opinions of any celebrity, we shall lay before our readers a short extract from Dulaure's Critical History of the French Nobility, which contains, in few but forcible words, some of the common arguments against this distinction of ranks.

"Nobility (says he), a distinction equally impolitic and immoral, and worthy of the times of ignorance and of rapine, which gave it birth, is a violation of the rights of that part of the nation that is deprived of it; and as equality becomes a *stimulus* towards distinction, so on the other hand this is the radical vice of a government and the source of a variety of evils. It is almost impossible that there should be any uncommon instances of virtue in a state, when recompenses belong exclusively to a certain class of society, and when it costs them no more to obtain these than the *trouble of being born*. Amongst this list of privileged persons, virtues, talents, and genius, must of course be much less frequent than in the other classes, since, without the possession of any of these qualities, they who belong to it are still honoured and rewarded. Those who profit by this absurd subversion of principles, and those who lose by this unjust distribution of favours, which seem to have grown into a right, cannot have any other than false, immoral, and pernicious ideas concerning *merit*."

A perfect equality, however, in rank and fortune has seldom been contended for, except by the most ignorant enthusiasts. It is indeed doubtful whether it could possibly exist. The more moderate and rational reformers have acknowledged, that as these differences have always existed in some way or other, so, from the infinite variety of talents and attainments in the world, we have reason to expect they will exist in every form of government and among every people. The question, therefore, is reduced to this: Whether the present mode of distinction, or any other which could be instituted in its stead, be upon the whole the best? That the present is not perfect, or wholly without faults, few will be sanguine enough to contradict: and a wise man in the sober hour of philosophical reflection will scarce presume to assert, that any other scheme which human ingenuity can plan would be wholly without imperfection, or altogether free from error. The case is, the errors of our own system are present, and on this account we see and feel them with peculiar force: the other plan we look forward to perhaps in too sanguine a manner, and we probably forget, in the delusive heat of imagination, that if distinction depended entirely on merit, we should scarce find a society of men so honest, or so able, as always to reward it according to its deserts; or if this were possible, as perhaps in the nature of things it is not, such is the self-partiality of the generality of men, that few would think he were dealt justly by if he were not promoted as well as his neighbour; and it is clearly impossible to promote every one. For such reasons then, and many more which our limits oblige us to omit, many think (and we are inclined to think with them), that it is safer to remain as we are, as we know the evils that attend our situation, and are still able to bear them, rather than to hazard a change, which, Nobility.

which, with some benefits, might also perhaps increase the troubles, and destroy many of the pleasures of social life.

Perhaps it may not be amiss to lay before our readers the following observations from that most judicious commentator on the laws of England, Mr Justice Blackstone, on this important subject.

Blackst. Comment.

"The distinction of rank and honours (says he) is necessary in every well-governed state, in order to reward such as are eminent for their services to the public, in a manner the most desirable to individuals, and yet without burden to the community; exciting thereby an ambitious, yet laudable ardour, and generous emulation, in others. And emulation, or virtuous ambition, is a spring of action which, however dangerous or invidious in a mere republic or under a despotic sway, will certainly be attended with good effects under a free monarchy; where, without destroying its existence, its excesses may be continually restrained by that superior power from which all honour is derived. Such a spirit, when nationally diffused, gives life and vigour to the community; it sets all the wheels of government in motion, which, under a wise regulator, may be directed to any beneficial purpose; and thereby every individual may be made subservient to the public good, while he principally means to promote his own particular views. A body of nobility is also more peculiarly necessary in our mixed and compounded constitution, in order to support the rights of both the crown and the people, by forming a barrier to withstand the encroachments of both. It creates and preserves that gradual scale of dignity, which proceeds from the peasant to the prince; rising like a pyramid from a broad foundation, and diminishing to a point as it rises. It is this ascending and contracting proportion that adds stability to any government; for when the departure is sudden from one extreme to another, we may pronounce that state to be precarious. The nobility, therefore, are the pillars, which are reared from among the people, more immediately to support the throne; and, if that falls, they must also be buried under its ruins. Accordingly, when in the 17th century the commons had determined to extirpate monarchy, they also voted the house of lords to be useless and dangerous. And since titles of nobility are thus expedient in the state, it is also expedient that their owners should form an independent and separate branch of the legislature. If they were confounded with the mass of the people, and like them had only a vote in electing representatives, their privileges would soon be borne down and overwhelmed by the popular torrent, which would effectually level all distinctions. It is therefore highly necessary that the body of nobles should have a distinct assembly, distinct deliberations, and distinct powers from the commons."—These remarks, at a time like the present, deserve our serious attention; nor do we suppose our readers will be displeased, if we add the following observations on the subject from a periodical publication of long standing and very considerable merit.

Gent. Mag. vol. xii.

"Birth and nobility are a stronger obligation to virtue than is laid upon meaner persons. A vicious or dishonourable nobleman is in effect perjured; for his honour is his oath.

"Under the patriarchal scheme, and at the first setting out of the tribes, the heads of families had their particular escutcheons, and their genealogies recorded with the utmost exactness: Even the Ancient of Days confirmed this,; he often put his people in mind of the glory and virtues of their forefathers; and hath set a precedent for attainders, by visiting the third and fourth generation.

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"It is a vulgar error to suppose, that his blessed Son chose his followers out of the meanest of the people, because mechanics; for this was part of the education of every Jewish nobleman: Two of the number, being his kinsmen, were of the royal house of David; one was a Roman gentleman, and another of the royal family of Syria; and for the rest, he had the same right of creation as his Father and his vicegerents, of advancing the poor to honour, and of exalting the lowly and meek.

"The ancient Greeks and Romans paid great regard to nobility; but when the levelling principle obtained, and the people shared power and honour, those states soon dwindled and came to ruin. And in present Rome, great respect is paid to the renowned families of Colonna and Cæsarini. In Venice, the notion of nobility is carried so high as to become inconsistent with a republican scheme. The Spaniards pay more regard to their old nobles than to their old Christians; and the French are but little behind them. What was said of the duke of Montmorency by Henry IV. "That he was a better gentleman than himself," was, perhaps, the reason why the last heir of so illustrious a family was cut off, to make the house of Bourbon the first in France.—The Welsh, Irish, and Polanders, are remarkable for their attachment to blood and pedigree.

"It is for the sake of the meanest of our people, that the high value and regard for quality should be kept up; for they are best governed by those who seem formed for power: the robe of authority sits easy upon them, and submission is as much our choice as our duty; but upstarts prove the worst of tyrants.

"The ancient legislators, who studied human nature, thought it adviseable, for the better government of states, that the people should be divided into the noble and the common. They judged it for the universal good of mankind, that the valiant and the wise should be separated from the rest, and appointed for council and command.

"To this I take it that the institution of nobility is owing in all countries; even those nations which we are pleased to call *savage*, distinguish the wise and the valiant, obey them as counsellors and commanders, which is placing them in the rank of nobles.

"Some, I know, look upon the institution of nobility to be one of the grossest impositions upon the common sense of mankind; they confine it indeed to hereditary nobility; they allow, that those who have done the commonwealth any signal service should be distinguished with honours, but it seems an absurdity to them that a man should be born a legislator, as if wisdom or a knowledge of government ran in the blood. But if they would consider how strong the love of posterity is planted in human nature, they must allow that nothing can be a stronger motive to great and worthy actions, than the notion that a man's posterity will reap the honour and profit of his labours.

 Besides

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Besides, we are to suppose that men born to honours and a high fortune may be bred up in generous sentiments, and formed for the station they are to fill; that they must be strangers to those vicious falsehoods and corruptions which necessity first, and then habit, puts men upon practising, whose lives are spent in pursuit of their fortunes. I will own, notwithstanding all these advantages, that many of them are like rocks whose heads are in the clouds, but are so barren that they are quite incapable of producing any thing; but in general, were their minds only upon a level with those of other men, we should expect better fruit from them.

"As authority is founded in opinion, all wise commonwealths have been extremely jealous in keeping up the honour of their nobility. Wherever they become base, effeminate, cowardly, or servile, their authority sinks, they fall into contempt; then the people begin to consider them as useless to government, and look upon their privileges as a grievance to society, and perhaps they think how to get rid of them, as happened in the commonwealth of Florence, where, after the expulsion of the duke of Athens, a petty tyrant of that city, many of the nobility having behaved servilely to him, and insolently to the people, were degraded from the senate and the magistracy, and rendered incapable of holding any employment in the commonwealth.

"Father Paul, the Venetian, says, that you must either keep your nobility free from taint, or have no nobility at all: That the high employments of the commonwealth should be bestowed amongst the most ancient families, unless where a person should distinguish himself by some signal service to the state. Such a man would think himself sufficiently rewarded by the honour of being out upon a footing with the ancient nobility; and the nobility would be pleased to find that no commoner, except some of great reputation and merit, was to hold any of the employments usually possessed by their body. If the person so preferred should not be rich enough to support the dignity of the office, the state may give him a pension, but by no means should employments be made lucrative; which not only exhaust and weaken the commonwealth, but wherever the high employments are sought for profit, the nobility lose their generous sentiments, and it is a means of introducing corruption amongst them."

The origin of nobility in Europe is by some referred to the Goths; who, after they had seized a part of Europe, rewarded their captains with titles of honour, to distinguish them from the common people. We shall only in this place further consider the manner in which in our own country they may be created, and the incidents attending them; referring for a fuller account of their origin in Europe to the articles REVOLUTION, and *Civil* SOCIETY.

1. The right of peerage seems to have been originally territorial; that is, annexed to lands, honours, castles, manors, and the like; the proprietors and possessors of which were (in right of those estates) allowed to be peers of the realm, and were summoned to parliament to do suit and service to their sovereign: and, when the land was alienated, the dignity passed with it as appendant. Thus in England the bishops still sit in the house of lords in right of succession to certain ancient baronies annexed, or supposed to be annexed, to their episcopal lands; and thus in 11. Henry VI. the possession of the castle of Arundel was adjudged to confer an earldom on its possessor. But afterwards, when ALIENATIONS grew to be frequent, the dignity of peerage was confined to the lineage of the party ennobled, and instead of territorial became personal. Actual proof of a tenure by barony became no longer necessary to constitute a lord of parliament; but the record of the writ of summons to him or his ancestors was admitted as a sufficient evidence of the tenure.

Blackst. Comment.

Peers of Great Britain are now created either by writ or by patent; for those who claim by prescription must suppose either a writ or patent made to their ancestors; though by length of time it is lost. The creation by writ or the king's letter is a summons to attend the house of peers, by the style and title of that barony which the king is pleased to confer: that by patent is a royal grant to a subject of any dignity and degree of peerage. The creation by writ is the more ancient way; but a man is not ennobled thereby, unless he actually take his seat in the house of lords; and some are of opinion that there must be at least two writs of summons, and a sitting in two distinct parliaments, to evidence a hereditary barony; and therefore the most usual, because the surest way, is to grant the dignity by patent, which endures to a man and his heirs according to the limitation thereof, though he never himself makes use of it. Yet it is frequent to call up the eldest son of a peer to the house of lords by writ of summons, in the name of his father's barony, because in that case there is no danger of his children's losing the nobility in case he never takes his seat; for they will succeed to their grandfather. Creation by writ has also one advantage over that by patent; for a person created by writ holds the dignity to him and his heirs, without any words to that purport in the writ; but in letters patent there must be words to direct the inheritance, else the dignity endures only to the grantee for life. For a man or woman may be created noble for their own lives, and the dignity not descend to their heirs at all, or descend only to some particular heirs: as where a peerage is limited to a man and the heirs male of his body by Elizabeth his present lady, and not to such heirs by any former or future wife.

2. Let us next take a view of a few of the principal incidents attending the nobility,—exclusive of their capacity as members of parliament, and as hereditary counsellors of the crown; for both which we refer to the articles LORDS and PARLIAMENT. And first we must observe, that in criminal cases a nobleman shall be tried by his peers. The great are always obnoxious to popular envy: were they to be judged by the people, they might be in danger from the prejudices of their judges; and would moreover be deprived of the privilege of the meanest subjects, that of being tried by their equals, which is secured to all the realm by magna charta, c. 29. It is said, that this does not extend to bishops, who, though they are lords of parliament, and sit there by virtue of their baronies which they hold *jure ecclesiæ*, yet are not ennobled in blood, and consequently not peers with the nobility. As to peeresses, no provision was made for their

Nobility. their trial when accused of treason or felony, till after Eleanor duchess of Gloucester, wife to the lord protector, had been accused of treason, and found guilty of witchcraft, in an ecclesiastical synod, through the intrigues of Cardinal Beaufort. This very extraordinary trial gave occasion to a special statute, 20 Hen. II. c. 9. which enacts, that peeresses, either in their own right or by marriage, shall be tried before the same judicators as peers of the realm. If a woman, noble in her own right, marries a commoner, she still remains noble, and shall be tried by her peers; but if she be only noble by marriage, then by a second marriage with a commoner she loses her dignity; for as by marriage it is gained, by marriage it is also lost. Yet if a duchess dowager marries a baron, she continues a duchess still: for all the nobility are *pares*, and therefore it is no degradation. A peer or peeress (either in her own right or by marriage) cannot be arrested in civil cases: and they have also many peculiar privileges annexed to their peerage in the course of judicial proceedings. A peer sitting in judgment, gives not his verdict upon oath, like an ordinary juryman, but upon his honour; he answers also to bills in chancery upon his honour, and not upon his oath: but when he is examined as a witness either in civil or criminal cases, he must be sworn; for the respect which the law shows to the honour of a peer does not extend so far as to overturn a settled maxim, that *in judicio non creditur nisi juratus*. The honour of peers is however so highly tendered by the law, that it is much more penal to spread false reports of them, and certain other great officers of the realm, than of other men: scandal against them being called by the peculiar name of *scandalum magnatum*, and subjected to peculiar punishment by divers ancient statutes.

A peer cannot lose his nobility but by death or attainder; though there was an instance, in the reign of Edward IV. of the degradation of George Neville duke of Bedford by act of parliament, on account of his poverty, which rendered him unable to support his dignity. But this is a singular instance, which serves at the same time, by having happened, to show the power of parliament; and, by having happened but once, to show how tender the parliament hath been in exerting so high a power. It hath been said indeed, that if a baron wastes his estate, so that he is not able to support the degree, the king may degrade him: but it is expressly held by later authorities, that a peer cannot be degraded but by act of parliament.

Anton. Matthæus observes, that nobility, among the Romans, was a quite different thing from what it is among us. The nobles, among the Romans, were either those raised to the magistrature, or descended from magistrates: there was no such thing as nobility by patent.

Bartoli says, that doctors, after they have held a professor's chair in an university for 20 years, become noble; and are entitled to all the rights of counts.

But this claim is not admitted at court, &c. though Bartoli's sentiments be backed with those of several other authors, particularly Chassanæus in his *Consuetudin. Burgundiæ; Boyer sur la Coutume de Berry; Faber C. de Dig. Def.* 9. &c. which last, however, restrains Bartoli's rule to doctors in law, and princes physicians.

By an edict of the French king in 1669, it is declared, that trade shall not derogate from nobility, provided the person do not sell by retail.

Nobility, Noble. In Bretagne, by ancient custom, a nobleman loses nothing by trading even in retail; but he reassumes all his rights as soon as he ceases traffic, his nobility having slept all the time.

In Germany, a woman, not noble by birth, doth not become, *v. gr.* a countess or baroness by marrying a count or baron: a lady of the higher degree indeed becomes a princess by marrying a prince; but this does not hold of a lady of the lower nobility.

On the coast of Malabar, children are only capable of being noble by the mother's side; it being allowed them to take as many husbands as they please, and to quit them whenever they think proper.

NOBLE, *Nobilis*, a person who has a privilege which raises him above a commoner or peasant, either by birth, by office, or by patent from his prince. The word comes from the Latin *nobilis;* formed from the ancient *noscibilis*, "distinguishable, remarkable."

In England, the word *noble* is of a narrower import than in other countries, being confined to persons above the degree of knights; whereas, abroad, it comprehends not only knights, but what we simply call *gentlemen*. The nobles of England are also called *pares regni*, as being *nobilitatis pares*, though *gradu impares*.

The Venetian *noblesse* is famous: it is in this that the sovereignty of the state resides. It is divided into three classes. The first only comprehends 24 families. The second includes the descendants of all those who were entered into the Golden Book, in 1289, and destined to govern the state, which then began to be aristocratic. The third consists of such as have bought the dignity of noble Venetians. This last class is only admitted to the inferior employs; the two former to all indifferently. The title of *noble Venetians* is sometimes also given to foreign kings, princes, &c.

NOBLES, among the Romans, were such as had the *jus imaginum*, or the right of using the pictures or statues of their ancestors; a right which was allowed only to those whose ancestors had borne some *curule* office, that is, had been *curule ædile, censor, prætor* or *consul*. For a long time, none but the *patricii* were the *nobiles*, because no person but of that superior rank could bear any *curule* office; hence in Livy, Sallust, &c. *nobilitas* is used to signify the patrician order, and so opposed to *plebs*. To make the true meaning of *nobiles* still more clear, let it be observed, that the Roman people were divided into *nobiles*, *novi*, and *ignobiles*. *Nobiles* were they who had the pictures, &c. of their ancestors; *novi* were such as had only their own; *ignobiles* were such as had neither. See *Jus Imaginis*.

The Roman nobility, by way of distinction, wore a half-moon upon their shoes, especially those of patrician rank.

The Grecian nobility were called Ευπατριδαι, as being descended from those old heroic ancestors so famous in history. Such were the *Praxiergidæ, Etrobutidæ, Alcmæonidæ*, &c. all which had many privileges annexed to their quality; amongst which was this, that they wore grashoppers in their hair as a badge of nobility.

NOBLE, a money of account containing six shillings and eight pence.

The noble was anciently a real coin struck in the reign of Edward III. and then called the *penny of gold;* but

Noble || Noctambuli.

but it was afterwards called a *rose-noble*, from its being stamped with a rose: it was current at 6s. 8d.

NOCERA, a town in Italy, in the dominions of the king of Naples and Sicily, or, as he is more commonly called, the king of the Two Sicilies. It is an episcopal city, but might with greater propriety be styled a cluster of villages; its several parts being extended along the foot of the mountains, from the Cittá Sotana, or low town; and the bishop's palace, together with some convents embowered in cypress groves, cover the peak of a single hill in a very picturesque manner, and compose the Cittá Soprana.

Nocera (A), it is reported, contains near 30,000 inhabitants; they are dispersed in forty patches of habitation. Their houses are constructed of two kinds of stone: the common walls are built with yellow tufa dug out of the hills that lie about a mile to the east of the town; which stone seems unquestionably to have been formed by a consolidation of substances thrown out of Vesuvius, because, on opening these quarries, the workmen have frequently discovered tombs, vases, and coins locked up in the body of the stony stratum. The cases of their doors and windows are made of a black stone drawn from the hill of Fiano, two miles to the north: it lies eight feet below the surface, in a bed or vein 140 feet thick, resting upon a base of sand. This seems evidently to be a stream of lava congealed.

Nocera is a place of very considerable antiquity: in the 13th century it was called de Pagani, to distinguish it from a city in Umbria of a similar name; this addition was in allusion to a colony of Saracens which Frederick of Suabia brought from Sicily, and settled here, that they might be out of the way of their dangerous connexions with Africa: hence Nocera has often been confounded with Lucera by the negligent or ignorant chroniclers of the succeeding ages. The most remarkable event that occurs in its history is the siege of its castle, A. D. 1384. E. Long. 12. 49. N. Lat. 43. 1.

Terra Noceriana, Earth of Nocera, in the *Materia Medica*, a species of bole, remarkably heavy, of a grayish-white colour, of an insipid taste, and generally with some particles in it which grit between the teeth. It is much esteemed by the Italians as a remedy for venomous bites, and in fevers; but, excepting as an absorbent and astringent, no dependence is to be had on it.

NOCTAMBULI, NOCTAMBULONES, or *Night-walkers*; a term of equal import with *somnambuli*, applied to persons who have a habit of rising and walking about in their sleep. The word is a compound of the Latin *nox*, "night," and *ambulo*, "I walk."

Schenkius, Horstius, Glauderus, and Hildanus, who have written of sleep, give us divers unhappy histories of such noctambuli. When the disease is moderate, the persons affected with it only repeat the actions of the day on getting out of bed, and go quietly to the places they frequented at other times; but those who have it in the most violent degree, go up to dangerous places, and do things which would terrify them to think of when they are awake. These are by some called *lunatic* night-walkers, because fits are observed to return with the most frequency and violence at the changes of the moon.—For the cure some recommend purging and a cooling regimen: others are of opinion that the best method is to place a vessel of water at the patient's bedside, in such a manner that he will naturally step into it when he gets out of bed; or if that should fail, a person should sit up to watch and beat him every time it happens. See SLEEP-WALKERS, or SOMNAMBULI.

Noctambuli || Nocturnal.

NOCTILUCA, a species of phosphorus, so called because it shines in the dark without any light being thrown upon it.

NOCTURNAL, something relating to the night, in contradistinction to diurnal.

NOCTURNAL, *Nocturlabium*, an instrument chiefly used at sea, to take the altitude or depression of some stars about the pole, in order to find the latitude and hour of the night.

Some nocturnals are hemispheres, or planispheres, on the plane of the equinoctial. Those commonly in use among seamen are two; the one adapted to the polar star, and the first of the guards of the Little Bear; the other to the pole star, and the pointers of the Great Bear.

This instrument consists of two circular plates, applied to each other. The greater, which has a handle to hold the instrument, is about 2½ inches diameter, and is divided into twelve parts, agreeing to the twelve months; and each month subdivided into every fifth day; and so as that the middle of the handle corresponds to that day of the year, wherein the star here regarded has the same right ascension with the sun. If the instrument be fitted for two stars, the handle is made moveable. The upper left circle is divided into twenty-four equal parts for the twenty-four hours of the day, and each hour subdivided into quarters. These twenty-four hours are noted by twenty-four teeth to be told in the night. Those at the hour 12 are distinguished by their length. In the centre of the two circular plates is adjusted a long index, moveable upon the upper plate; and the three pieces, viz. the two circles and index, are joined by a rivet which is pierced through the centre with a hole, through which the star is to be observed. Plate CCCLXX.

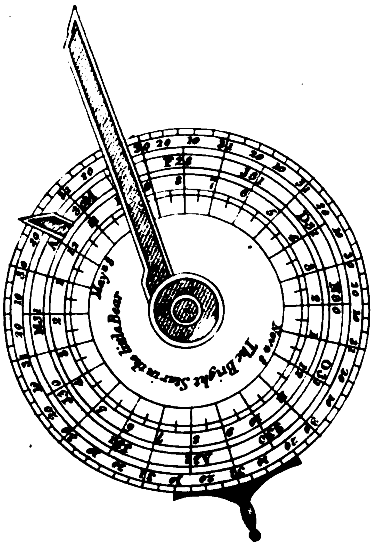
To use the nocturnal, turn the upper plate till the long tooth, marked 12, be against the day of the month on the under plate; then, bringing the instrument near the eye, suspend it by the handle with the plane nearly parallel to the equinoctial, and viewing the pole star through the hole of the centre, turn the index about, till, by the edge coming from the centre, you see the bright star or guard of the Little Bear, (if the instrument be fitted to that star): then that tooth of the upper circle, under the edge of the index, is at the hour of the night on the edge of the hour circle, which may be known without a light, by counting the teeth from the longest, which is for the hour 12.

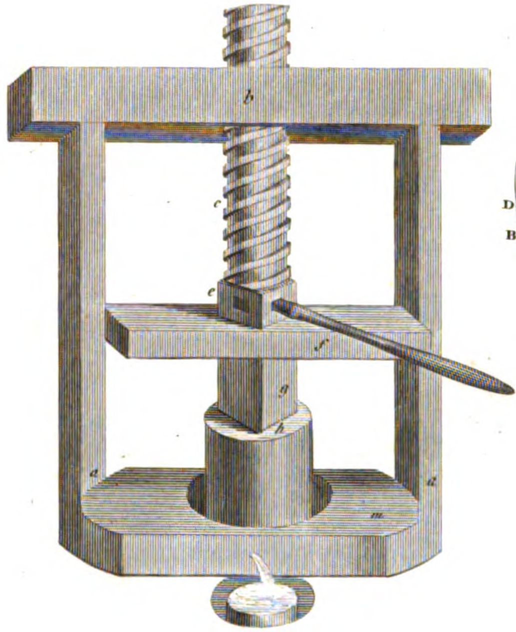
NOD,

(A) Anciently, Nuceria Alphaterna, a word of unknown etymology. It was a Roman colony, and had its mint. Num. Nucerin.

1. Caput virile imberbe. Equus stans capite reflexo inter crura. A . . IN . .

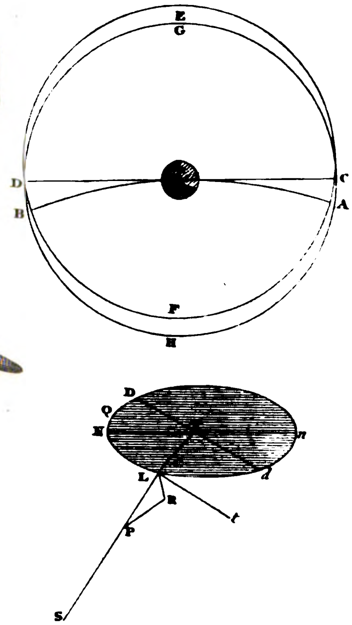
NOCTURNAL



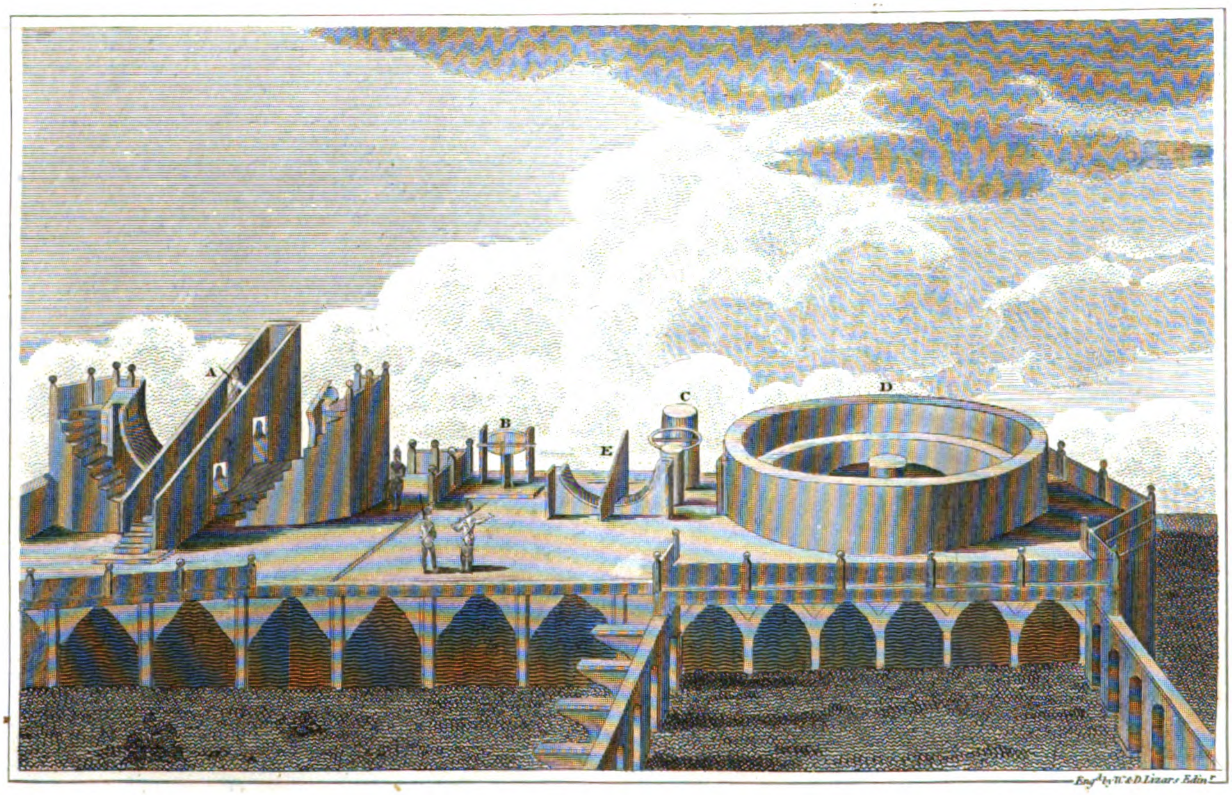


NODES

Fig. 1.



BRAMIN'S OBSERVATORY



Eng^d by W. & D. Lizars Edin^r.

NOD, or the *Land of Nod*. It was to this country that Cain withdrew after his fratricide, (Gen. iv. 16.). The Septuagint, as well as Josephus, read *Naid* instead of *Nod*, and have taken it for the name of a place. It is not easily known what country this was, unless perhaps it was the country of Nyse or Nysea, towards Hyrcania. St Jerome and the Chaldee interpreters have taken the word Nod in the sense of an appellative, for *vagabond* or *fugitive*; "He dwelt a fugitive in the land." But the Hebrew reads, "He dwelt in the land of Nod," (Gen. iv. 16.)

NODAB, a country bordering upon Iturea and Idumæa, but now unknown. We read in the Chronicles, that the tribe of Reuben, assisted by those of Gad and Manasseh, had a war against the Hagarites, the Jeturites, and the people of Nephish, and of Nodab, in which the Israelites had the advantage (1 Chr. v. 19.). But the time and the other particulars of this war are unknown.

NODATED HYPERBOLA, a name given by Sir Isaac Newton to a kind of hyperbola, which, by turning round, decussates or crosses itself.

NODDY. See STERNA, ORNITHOLOGY *Index*.

NODE, a tumor arising on the bones, and usually proceeding from some venereal cause; being much the same with what is otherwise called *exostosis*.

NODES, in *Astronomy*, the two points where the orbit of a planet intersects the ecliptic.

Plate CCCLXX. fig. 1.

Such are the two points C and D, fig. 1. of which the node C, where the planet ascends northward above the plane of the ecliptic, is called the *ascending node*, or the *dragon's head*, and is marked thus ☊. The other node D, where the planet descends to the south, is called the *descending node*, or the *dragon's tail*, marked thus ☋.

The line CD, wherein the two circles CEDF and CGDH intersect, is called the *line of nodes*. It appears from observation, that the line of the nodes of all the planets constantly changes its place, and shifts its situation from east to west, contrary to the order of the signs; and that the line of the moon's nodes, by a retrograde motion, finishes its circulation in the compass of 19 years; after which time, either of the nodes having receded from any point of the ecliptic, returns to the same again; and when the moon is in the node, she is also seen in the ecliptic. If the line of nodes were immoveable, that is, if it had no other motion than that whereby it is carried round the sun, it would always look to the same point of the ecliptic, or would keep parallel to itself, as the axis of the earth does.

From what hath been said, it is evident, that the moon can never be observed precisely in the ecliptic, but twice in every period; that is, when she enters the nodes. When she is at her greatest distance from the nodes, viz. in the points E, F, she is said to be in her limits.

The moon must be in or near one of the nodes, when there is an eclipse of the sun or moon.

To make the foregoing account of the motion of the moon's nodes still clearer, let the plane of fig. 2. represent that of the ecliptic, S the sun, T the centre of the earth, L the moon in her orbit DN*dn*. N*n* is the line of the nodes passing between the quadrature Q and the moon's place L, in her last quarter. Let now LP, or any part LS, represent the excess of the sun's action at T; and this being resolved into the force LR, perpendicular to the plane of the moon's orbit, and PR parallel to it, it is the former only that has any effect to alter the position of the orbit, and in this it is wholly exerted. Its effect is twofold: 1. It diminishes its inclination by a motion which we may conceive as performed round the diameter D*d*, to which LT is perpendicular. 2. Being compounded with the moon's tangential motion at L, it gives it an intermediate direction L*t*, through which and the centre a plane being drawn, must meet the ecliptic nearer the conjunction C than before.

NODUS, or NODE, in *Dialling*, a certain point or pole in the gnomon of a dial, by the shadow or light whereof either the hour of the day in dials without furniture, or the parallels of the sun's declination, and his place in the ecliptic, &c. in dials with furniture are shown. See DIALLING.

NOEOMAGUS LEXUVIORUM, (Ptol.); thought to be the *Civitas Lexoviorum* of the lower age. Now *Lisieux*, a city in Normandy.—Another of the *Tricastini*; a town of Gallia Narbonensis; thought to be *S. Pol. de Trois Chateaux*, six miles to the west of Nyons in Dauphiné.

NOETIANS, in church history, Christian heretics in the third century, followers of Noetius, a philosopher of Ephesus, who pretended that he was another Moses sent by God, and that his brother was a new Aaron. His heresy consisted in affirming that there was but one person in the Godhead; and that the Word and the Holy Spirit were but external denominations given to God in consequence of different operations: that, as Creator, he is called *Father*; as Incarnate, *Son*; and as descending on the apostles, *Holy Ghost*.

NOLA, a very ancient city, formerly populous and strong, situated in a plain to the north-east of Vesuvius, in Campania, said to be built by the Chalcidians; (Justin, Silius Italicus); according to others by the Tuscans. At this place Hannibal met with the first check by Marcellus. Vespasian added the appellation *Augusta Colonia*, (Frontinus). At this place, or in its neighbourhood, Augustus is said to have expired. It is also said that bells were first invented there in the beginning of the 5th century; hence their Latin names *Nolæ* or *Campanæ*. It retains its old name to this day, but has greatly declined from its ancient splendour. A town of the kingdom of Naples. E. Long. 15. N. Lat. 41. 5.

NOLANA, a genus of plants belonging to the pentandria class; and in the natural method ranking under the 41st order, *Asperifoliæ*. See BOTANY *Index*.

NOLLE PROSEQUI, is where a plaintiff in an action does not declare in a reasonable time; in which case it is usual for the defendant's attorney to enter a rule for the plaintiff to declare, after which a *non pros.* may be entered. A *nolle prosequi* is esteemed a voluntary confession, that the plaintiff has no cause of action; and therefore if a plaintiff enters his *nolle prosequi*, he shall be amerced; and if an informer cause the same to be entered, the defendant shall have costs.

NOLLET, JEAN ANTOINE, a deacon, licentiate in theology, preceptor to the *Enfans de France* for physics and natural history, regius professor of physics in the college of Navarre, member of the Academy of Sciences

Nollet. Sciences at Paris, of the Royal Society of London, of the Institution of Bologna, and of the Academy of Sciences of Erfort; was born at Pimbré, in the diocese of Noyon, on the 17th of November 1700, of respectable but not wealthy parents. To make up the want of riches, they determined to give their son a good education. They sent him to the college of Clermont in Beauvoisis, and afterwards to Beauvais, there to finish his introductory studies. The progress which he made in the different classes, determined them to send him to study philosophy at Paris. Thenceforward they intended him for the clerical order; and they considered the strictness and purity of his morals, together with his unwearied application to study, as sufficient proofs of his vocation. The young Nollet yielded without reluctance to the wishes of his parents. As soon as he was capable of showing an inclination for any thing, he had discovered a taste for physics; but this was not become his ruling passion; he therefore sacrificed it to the study of scholastic divinity, to which he wholly dedicated himself during his time of probation in 1728. No sooner had he been invested with the deaconship, than he solicited and obtained a licence to preach. This new occupation, however, did not make him entirely lose sight of those studies which had first engaged his attention. They insensibly began to occupy a greater portion of his time, which was now more equally divided between theology and the sciences. The latter, however, prevailed; and thenceforth he entered into the study of physics with an ardour which was only increased by that kind of privation to which he had been long subject. He was received into the Society of Arts, established at Paris under the patronage of the late count de Clermont. In 1730, the abbé Nollet was engaged in a work conjunctly with Reaumur and du Fay of the Academy of Sciences. In 1734, he went to London in company with M. M. du Fay, du Hamel, and de Jussieu. His merit procured him a place in the Royal Society without any solicitation. Two years after, he went to Holland, where he formed an intimate connection with Desaguliers, Gravesande, and Muschenbroeck. On his return to Paris, he resumed the course of experimental physics which he had begun in 1735, and which he continued till 1760. These courses of physics first suggested the idea of particular courses in other branches of science, such as in chemistry, anatomy, natural history, &c. In 1738, the count de Maurepas prevailed on the cardinal Fleury to establish a public class for experimental physics; and the abbé Nollet was appointed the first professor. In the beginning of the year 1739, he was admitted a member of the Royal Academy of Sciences; and in the month of April following, the king of Sardinia intending to establish a professorship of physics at Turin, invited the abbé Nollet into his dominions. From thence he travelled into Italy. In 1744, he was honoured with an invitation to Versailles, to instruct the dauphin in experimental philosophy; the king and royal family were often present at his lectures. The qualities as well of his understanding as of his heart gained him the esteem and confidence of his pupil. Going one day in state to Paris, he caused intimation to be made that he was to dine at the Thuilleries. M. Nollet having gone thither to pay his court, the dauphin no sooner perceived him, than he had the goodness to say, "Binet has the advantage of me, he has been at your house." Till the period of his death, this prince showed marks of the strongest attachment and favour for this ingenious philosopher. He would have wished that he had been a little more attentive to the improvement of his fortune. He prevailed upon him to go and pay court to a man in power, whose patronage might have been of service to him. The abbé Nollet accordingly waited upon the placeman, and made him a present of his works. "I never read any works of that kind," said the patron coldly, and casting a look at the volumes before him. "Sir (replied the abbé), will you allow them to remain in your antichamber? There perhaps there may be found men of genius who will read them with pleasure." In the month of April 1749, he made a grand tour into Italy, being sent thither for the purpose of making observations. At Turin, Venice, and Bologna, the abbé Nollet appeared as a deputy from the philosophers of the rest of Europe. During his short stay in Italy, the wonders of electricity were not the only object of his researches; every part of physics, the arts, agriculture, &c. came equally under his notice. Upon his return through Turin, the king of Sardinia, always truly sensible of his merit, offered him the order of Saint Maurice, which he did not think proper to accept without his sovereign's permission. In 1753 the king instituted a class of experimental philosophy in the royal college of Navarre, and appointed the abbé Nollet professor. In 1757, he received from the king a brevet appointing him preceptor in physics and natural history to the *Enfans de France*. In the month of August, the same year, he was appointed professor of experimental philosophy in the school of artillery, at that time established at la Fere. In the month of November following, he was admitted as a pensionary of the Royal Academy of Sciences. M. de Cremillo, director general of artillery and fortification, having founded a class of experimental philosophy at Mezieres in 1761, the abbé Nollet was appointed professor. This celebrated and laborious philosopher, who has rendered the most important services to physics by the discoveries with which he has enriched every branch of this science, but particularly electricity, died at Paris on the 25th of April 1770, aged 70; much regretted by the literary world, and by his friends, of whom his gentle character and beneficent heart had procured him a great number. He often retired from the gay and splendid societies of Paris, to give assistance to his relations, who were by no means in affluent circumstances. His works are 1. Several papers inserted in the memoirs of the Academy of Sciences; among which one on the Hearing of Fishes is particularly valuable. 2. *Leçons de Physique Experimentale*, 6 vols 12mo; a book well composed, and uniting pleasure with instruction. 3. *Recueil de Lettres sur l'Electricité*, 3 vols 12mo, 1753. 4. *Essai sur l'Electricité des corps*, 1 vol. 12mo. 5. *Recherches sur les causes particulieres des Phenoménes Electriques*, 1 vol. 12mo. 6. *L'Andes experiences*, 3 vols 12mo, with figures, 1770.

Nollet, Nomades.

NOMADES, a name given in antiquity, to several nations, whose whole occupation was to feed and tend their flocks; and who had no fixed place of abode, but were constantly shifting, according to the conveniences of pasturage.—The word comes from the Greek νεμω, *pasco*, "I feed."

The

The most celebrated among the Nomades were those of Africa, who inhabited between Africa properly so called, to the east, and Mauritania to the west. They are also called *Numidæ* or *Numidians*.—Sallust says, they were a colony of Persians brought into Africa with Hercules.

The Nomades of Asia inhabited the coasts of the Caspian sea. The Nomades of Scythia were the inhabitants of Little Tartary; who still retain the ancient manner of living.

NOMARCHA, in antiquity, the governor or commander of a nome or nomos.—Egypt was anciently divided into several regions or quarters, called *nomes*, from the Greek νομος, taken in the sense of a division; and the officer who had the administration of each *nome* or *nomos*, from the king, was called *nomarcha*, from νομος and αρχη, "command."

NOMBRE-DE-DIOS, a town of Mexico, in the province of Darien, a little to the eastward of Porto-Bello. It was formerly a famous place; but it is now abandoned, on account of its unhealthy situation. W. Long. 78. 35. N. Lat. 9. 43.

NOMBRIL POINT, in *Heraldry*, is the next below the fess point, or the very centre of the escutcheon.

Supposing the escutcheon divided into two equal parts below the fess, the first of these divisions is the nombril, and the lower the base.

NOME, or NAME, in *Algebra*, denotes any quantity with a sign prefixed or added to it, whereby it is connected with some other quantity, upon which the whole becomes a binomial, trinomial, or the like. See ALGEBRA.

NOMENCLATOR, in Roman antiquity, was usually a slave who attended upon persons that stood candidates for offices, and prompted or suggested to them the names of all the citizens they met, that they might court them and call them by their names, which among that people was the highest piece of civility.

NOMENCLATORS, among botanical authors, are those who have employed their labours about settling and adjusting the right names, synonymes, and etymologies of names, in regard to the whole vegetable world.

NOMENCLATURE, NOMENCLATURA, a catalogue of several of the more usual words in any language, with their significations, compiled in order to facilitate the use of such words to those who are to learn the tongue: such are our Latin, Greek, French, &c. nomenclatures: Or a system of technical language by which the objects of any science are denoted, as, for instance, the present language of chemical science, usually called the *new chemical nomenclature*, from its recent construction.

NOMENEY, a town in France, in the department of Meurthe, situated on the river Seille, 15 miles north of Nancy.

NOMINALS, or NOMINALISTS, a sect of school philosophers, the disciples and followers of Occam, or Ocham, an English Cordelier, in the 14th century. They were great dealers in words, whence they were vulgarly denominated *Word-sellers*; but had the denomination of *Nominalists*, because, in opposition to the *Realists*, they maintained, that words, and not things, were the object of dialectics.

This sect had its first rise towards the end of the 11th century, and pretended to follow Porphyry and Aristotle; but it was not till Ocham's time that they bore the name. The chief of this sect, in the 11th century, was a person called *John*, who, on account of his logical subtility, was called the *sophist*; and his principal disciples were Robert of Paris, Roscelin of Compiegne, and Arnoul of Laon. At the beginning, the Nominals had the upper hand: but the Realists, though greatly divided among themselves, were supported by men of great abilities; such as Albertus Magnus, T. Aquinas, and Duns Scotus. The Nominal sect came hereby into disrepute; till William Occam, in the 14th century, again revived it, and filled France and Germany with the flame of disputation. Having joined the party of the Franciscan monks, who strenuously opposed John XXII. that pope himself, and his successors after him, left no means untried to extirpate the philosophy of the Nominalists, which was deemed highly prejudicial to the interests of the church: and hence it was, that in the year 1339, the university of Paris, by a public edict, solemnly condemned and prohibited the philosophy of Occam, which was that of the Nominalists. The consequence was, that the Nominalists flourished more than ever. In the 15th century, the controversy was continued with more vigour and animosity than before; and the disputants were not content with using merely the force of eloquence, but had frequently recourse to more hostile and dangerous weapons; and battles were the consequence of a philosophical question, which neither side understood. In most places, however, the Realists maintained a manifest superiority over the Nominalists. While the famous Gerson and the most eminent of his disciples were living, the Nominalists were in high esteem and credit in the university of Paris. But upon the death of these patrons, the face of things was much changed to their disadvantage. In the year 1473, Louis XI. by the instigation of his confessor, the bishop of Avranches, issued out a severe edict against the doctrines of the Nominalists, and ordered all their writings to be seized and secured, that they might not be read by the people; but the same monarch mitigated this edict the year following, and permitted some of the books of that sect to be delivered from their confinement. In the year 1481, he not only granted a full liberty to the Nominalists and their writings, but also restored that philosophical sect to its former authority and lustre in the university.

The Nominalists were the founders of the university of Leipsic: and there are many yet abroad who pique themselves on being Nominals.

The Nominals, with the Stoics, admit the formal conceptions or ideas of things, as the subject and foundation of universality: but to this they add names, which represent and signify, after the same univocal manner, and without any distinction, a great variety of single things alike in genus and species.

Whence it is that they are called *Nominals*; as pretending, that to become learned, it is not enough to have just ideas of things, but it is likewise required to know the proper names of the genera and species of things, and to be able to express them clearly and precisely, without confusion or ambiguity.

NOMINATIVE, in *Grammar*, the first CASE of NOUNS which are declinable.

The simple position, or laying down of a noun, or name,

name, is called the *nominative case;* yet it is not so properly a case, as the matter or ground whence the other cases are to be formed, by the several changes and inflections given to this first termination. Its chief use is to be placed in discourse before all verbs, as the subject of the proposition or affirmation.

NONA, a city of Dalmatia, remarkable at present only for its ruins, which might furnish abundant materials to gratify the curiosity of antiquaries; but indeed they are so buried by repeated devastations, to which that unhappy city has been exposed, that rarely any vestige of them appears above ground. "I went thither (says Fortis in his Travels), in hopes of finding something worthy of notice, but was disappointed. Nothing is to be seen that indicates the grandeur of the Roman times; neither are there any remains of barbarous magnificence, to put one in mind of the ages in which the kings of the Croat Slavi had their residence there. It lies on a small island, surrounded by a harbour, which in former times was capable of receiving large ships; but is now become a fetid pool, by means of a little muddy river that falls into it, after a course of about six miles through the rich abandoned fields of that district. The ancient inhabitants turned this water into another channel, and made it run through the valley of Drasnich into the sea; and the remains of the bank raised by them for that purpose are still to be seen. Notwithstanding, however, the depopulation of this district, and the dreary situation of Nona in particular, the new inhabitants have not lost courage; and animated by the privileges granted to them by the most serene republic, are endeavouring to bring the population and agriculture once more into a flourishing state. Proper drains for the water would not only render that rich territory habitable, but moreover very fertile; and the brackish marsh that surrounds the walls of Nona is well calculated to supply a considerable quantity of fish, especially eels. The government generously granted the investiture to private persons, who already draw no inconsiderable advantage from the fishing; and did they but adopt better methods, they might every year salt many thousands of eels, which would greatly answer our internal commerce, and save at least a part of the money that goes out of the country for foreign salt fish. To the left of the city of Nona, the walls of some ancient ruinous buildings appear; which probably in ancient times were situated on the main land, though now surrounded by water. The sea forms a narrow channel in this place, which is easily fordable, and, at low water, the smallest boat can scarcely pass."

NONAGE, in *Law*, generally signifies all the time a person continues under the age of 21; but in a special sense, it is all the time that a person is under the age of 14.

NONAGESIMAL, or *Nonagesimal Degree*, called also the *Mid Heaven*, is the highest point, or 90th degree of the ecliptic, reckoned from its intersection with the horizon at any time; and its altitude is equal to the angle which the ecliptic makes with the horizon at their intersection, or equal to the distance of the zenith from the pole of the ecliptic. It is much used in the calculation of solar eclipses.

NONAGON, a figure having nine sides and angles. In a regular nonagon, or that whose angles and sides are all equal, if each side be 1, its area will be $6.1818242 = \frac{9}{4}$ of the tangent of 70°, to the radius 1.

NON, Cape, a promontory on the west coast of Africa, opposite to the Canary islands. W. Long. 12. 0. N. Lat. 44. 28.

NONCONFORMISTS, those who refuse to join the established worship.

Nonconformists, in England, are of two sorts. First, Such as absent themselves from divine worship in the established church through total irreligion, and attend the service of no other persuasion. These, by the statute 1 Eliz. c. 2. 23 Eliz. c. 1. and 3 Jac. I. c. 4. forfeit one shilling to the poor every Lord's day they so absent themselves, and 20l. to the king if they continue such default for a month together. And if they keep any inmate thus irreligiously disposed in their houses, they forfeit 10l. per month.

The second species of nonconformists are those who offend through a mistaken or perverse zeal. Such were esteemed, by the English laws enacted since the time of the Reformation, to be Papists and Protestant dissenters: both of which were supposed to be equally schismatics, in not communicating with the national church; with this difference, that the Papists divided from it upon material, though erroneous, reasons; but many of the dissenters upon matters of indifference, or, in other words, for no reason at all. "Yet certainly (says Sir William Blackstone) our ancestors were mistaken in their plans of compulsion and intolerance. The sin of schism, as such, is by no means the object of temporal coercion and punishment. If, through weakness of intellect, through misdirected piety, through perverseness and acerbity of temper, or (which is often the case) through a prospect of secular advantage in herding with a party, men quarrel with the ecclesiastical establishment, the civil magistrate has nothing to do with it; unless their tenets and practice are such as threaten ruin or disturbance to the state. He is bound indeed to protect the established church: and if this can be better effected by admitting none but its genuine members to offices of trust and emolument, he is certainly at liberty so to do; the disposal of offices being matter of favour and discretion. But this point being once secured, all persecution for diversity of opinions, however ridiculous or absurd they may be, is contrary to every principle of sound policy and civil freedom. The names and subordination of the clergy, the posture of devotion, the materials and colour of the minister's garment, the joining in a known or unknown form of prayer, and other matters of the same kind, must be left to the option of every man's private judgment.

Blackst. Comment.

"With regard therefore to *Protestant dissenters*, although the experience of their turbulent disposition in former times occasioned several disabilities and restrictions (which I shall not undertake to justify) to be laid upon them by abundance of statutes; yet at length the legislature, with a true spirit of magnanimity, extended that indulgence to these sectaries, which they themselves, when in power, had held to be countenancing schism, and denied to the church of England. The penalties are conditionally suspended by the statute 1 W. & M. st. 1. c. 18. "for exempting their majesties Protestant subjects, dissenting from the church of England, from the penalties of certain laws," commonly called

Noncon-formists. Blackst. Comment. called the *toleration act;* which declares, that neither the laws above mentioned, nor the statutes 1 Eliz. c. 2. § 14. 3 Jac. I. c. 4. and 5. nor any other penal laws made against Popish recusants (except the test acts), shall extend to any dissenters, other than Papists and such as deny the Trinity: provided, 1. That they take the oaths of allegiance and supremacy, (or make a similar affirmation, being Quakers), and subscribe the declaration against Popery. 2. That they repair to some congregation certified to and registered in the court of the bishop or archdeacon, or at the county sessions. 3. That the doors of such meeting-house shall be unlocked, unbarred, and unbolted; in default of which, the persons meeting there are still liable to all the penalties of the former acts. Dissenting teachers, in order to be exempted from the penalties of the statutes 13 and 14 Car. II. c. 4. 17 Car. II. c. 2. and 22 Car. II. c. 1. are also to subscribe the articles of religion mentioned in the statute 13 Eliz. c. 12. (viz. those which only concern the confession of the true Christain faith, and the doctrine of the sacraments), with an express exception of those relating to the government and powers of the church, and to infant baptism. And by stat. 10 Ann. c. 2. this toleration is ratified and confirmed; and it is declared, that the said act shall at all times be inviolably observed for the exempting such Protestant dissenters as are thereby intended from the pains and penalties therein mentioned. Thus, though the offence of non-conformity is by no means universally abrogated, it is suspended, and ceases to exist with regard to these Protestant dissenters, during their compliance with the conditions imposed by the act of toleration: and, under these conditions, all persons, who will approve themselves no Papists or oppugners of the Trinity, are left at full liberty to act as their consciences shall direct them in the matter of religious worship. And if any person shall wilfully, maliciously, or contemptuously disturb any congregation, assembled in any church or permitted meeting-house, or shall misuse any preacher or teacher there, he shall (by virtue of the same statute) be bound over to the sessions of the peace, and forfeit 20l. But by statute 5 Geo. I. c. 4. no mayor or principal magistrate must appear at any dissenting meeting with the ensigns of his office, on pain of disability to hold that or any other office: the legislature judging it a matter of propriety, that a mode of worship, set up in opposition to the nation, when allowed to be exercised in peace, should be exercised also with decency, gratitude, and humility. Neither doth the act of toleration extend to enervate those clauses of the statutes 13 & 14 Car. II. c. 4. and 17 Car. II. c. 2. which prohibit (upon pain of fine and imprisonment) all persons from teaching school, unless they be licensed by the ordinary, and subscribe a declaration of conformity to the liturgy of the church, and reverently frequent divine service *established* by the laws of this kingdom.

"As to *Papists* what has been said of the Protestant dissenters would hold equally strong for a general toleration of them; provided their separation was founded only upon difference of opinion in religion, and their principles did not also extend to a subversion of the civil government. If once they could be brought to renounce the supremacy of the Pope, they might quietly enjoy their seven sacraments; their purgatory and auricular confession; their worship of relicks and images; nay, even their transubstantiation. But while they acknowledge a foreign power, superior to the sovereignty of the kingdom, they cannot complain, if the laws of that kingdom will not treat them upon the footing of good subjects.

Noncon-formists.

"The following are the laws that have been enacted against the Papists; who may be divided into three classes, persons professing Popery, Popish recusants convict, and Popish priests. 1. Persons professing the Popish religion, besides the former penalties for not frequenting their parish church, are disabled from taking any lands either by descent or purchase, after 18 years of age, until they renounce their errors; they must at the age of 21 register their estates before acquired, and all future conveyances and wills relating to them; they are incapable of presenting to any advowson, or granting to any other person any avoidance of the same; they may not keep or teach any school, under pain of perpetual imprisonment; and, if they willingly say or hear mass, they forfeit the one 200, the other 100 merks, and each shall suffer a year's imprisonment. Thus much for persons, who, from the misfortune of family prejudices, or otherwise, have conceived an unhappy attachment to the Romish church from they infancy, and publicly profess its errors. But if any evil industry is used to rivet these errors upon them; if any person sends another abroad to be educated in the Popish religion, or to reside in any religious house abroad for that purpose, or contributes to their maintenance when there; both the sender, the sent, and the contributor, are disabled to sue in law or equity, to be executor or administrator to any person, to take any legacy or deed of gift, and to bear any office in the realm; and shall forfeit all their goods and chattels, and likewise all their real estate for life. And where these errors are also aggravated by apostasy or perversion; where a person is reconciled to the see of Rome, or procures others to be reconciled, the offence amounts to high treason. 2. Popish recusants, convicted in a court of law of not attending the service of the church of England, are subject to the following disabilities, penalties, and forfeitures, over and above those before mentioned. They are considered as persons excommunicated; they can hold no office or employment: they must not keep arms in their houses, but the same may be seized by the justices of the peace; they may not come within 10 miles of London, on pain of 100l.; they can bring no action at law or suit in equity; they are not permitted to travel above five miles from home, unless by license, upon pain of forfeiting all their goods; and they may not come to court, under pain of 100l. No marriage or burial of such recusant, or baptism of his child, shall be had otherwise than by the ministers of the church of England, under other severe penalties. A married woman, when recusant, shall forfeit two-thirds of her dower or jointure, may not be executrix or administratrix to her husband, or have any part of his goods; and during the coverture may be kept in prison, unless her husband redeems her, at the rate of 10l. a month, or the third part of all his lands. And lastly, as a feme-covert recusant may be imprisoned, so all others must, within three months after conviction, either submit and renounce their errors, or if required so to do by four justices, must abjure and renounce the realm: and if they do not depart, or if they re-

Nonconformists. *Blackst. Comment.*

turn without the king's licence, they shall be guilty of felony, and suffer death as felons, without benefit of clergy. There is also an inferior species of recusancy, (refusing to make the declaration against Popery enjoined by statute 30 Car. II. st. 2. when tendered by the proper magistrate); which, if the party resides within ten miles of London, makes him an absolute recusant convict; or, if at a greater distance, suspends him from having any seat in parliament, keeping arms in his house, or any horse above the value of 5l. 3. Popish priests are still in a more dangerous condition. By statute 11 & 12 W. III. c. 4. Popish priests, or bishops, celebrating mass or exercising any part of their functions in England, except in the houses of ambassadors, are liable to perpetual imprisonment. And by the statute 27 Eliz. c. 2. any Popish priest, born in the dominions of the crown of England, who shall come over hither from beyond sea (unless driven by stress of weather and tarrying only a reasonable time), or shall be in England three days without conforming and taking the oaths, is guilty of high treason: and all persons harbouring him are guilty of felony without the benefit of clergy.

"This is a short summary of the laws against the Papists; of which the president Montesquieu observes, that they are so rigorous, though not professedly of the sanguinary kind, that they do all the hurt that can possibly be done in cold blood. But in answer to this, it may be observed (what foreigners who only judge from our statute book are not fully apprized of); that these laws are seldom exerted to their utmost rigour: and indeed, if they were, it would be very difficult to excuse them. For they are rather to be accounted for from their history, and the urgency of the times which produced them, than to be approved (upon a cool review) as a standing system of law. The restless machinations of the Jesuits during the reign of Elizabeth, the turbulence and uneasiness of the Papists under the new religious establishment, and the boldness of their hopes and wishes for the succession of the queen of Scots, obliged the parliament to counteract so dangerous a spirit by laws of a great, and then perhaps necessary, severity. The powder-treason, in the succeeding reign, struck a panic into James I. which operated in different ways: it occasioned the enacting of new laws against the Papists; but deterred him from putting them in execution. The intrigues of Queen Henrietta in the reign of Charles I. the prospect of a Popish successor in that of Charles II. the assassination-plot in the reign of King William, and the avowed claim of a Popish pretender to the crown in subsequent reigns, will account for the extension of these penalties at those several periods of our history."

But now that all just fears of a pretender may be said to have vanished, and the power and influence of the pope has become feeble, ridiculous, and despicable, not only in Britain, but in almost every kingdom of Europe: and as in fact the British Catholics solemnly disclaim the dangerous principles ascribed to them *; the British legislature, giving way to that liberality of sentiment becoming Protestants, have lately repealed the most rigorous of the above edicts, viz. The punishment of Popish priests or Jesuits who should be found to teach or officiate in the services of that church; which acts were felony in foreigners, and high treason in the natives of this kingdom:—The forfeitures of Popish heirs, who had received their education abroad, and whose estates went to the next Protestant heir:—The power given to the son, or other relation, being a Protestant, to take possession of the father's or other relation's estate, during the life of the real proprietor:—And the debarring Papists from the power of acquiring any legal property by purchase.—In proposing the repeal of these penalties, it was observed, That, besides that some of them had now ceased to be necessary, others were at all times a disgrace to humanity. The imprisonment of a Popish priest for life, only for officiating in the services of his religion, was horrible in its nature: And although the mildness of government had hitherto softened the rigour of the law in the practice, it was to be remembered that the Roman Catholic priests constantly lay at the mercy of the basest and most abandoned of mankind—of common informers; for on the evidence of any of these wretches, the magisterial and judicial powers were of necessity bound to enforce all the shameful penalties of the act. Others of these penalties held out the most powerful temptations for the commission of acts of depravity, at the very thought of which our nature recoils with horror: They seemed calculated to loosen all the bands of society; to dissolve all civil, moral, and religious obligations and duties, to poison the sources of domestic felicity, and to annihilate every principle of honour. The encouragement given to children to lay their hands upon the estates of their parents, and the restriction which debars any man from the honest acquisition of property, need only to be mentioned to excite indignation in an enlightened age.

* See their loyal Address to the throne, May 1. 1778. as inserted in the Magazines or Annual Register for that year.

Nonconformists.

In order the better to secure the English established church against perils from nonconformists of all denominations, Infidels, Turks, Jews, Heretics, Papists, and Sectaries, there are, however, two bulwarks erected; called the *corporation* and *test acts*: By the former of which, no person can be legally elected to any office relating to the government of any city or corporation, unless, within a twelvemonth before, he has received the sacrament of the Lord's supper according to the rites of the church of England; and he is also enjoined to take the oaths of allegiance and supremacy at the same time that he takes the oath of office: or, in default of either of these requisites, such election shall be void. The other, called the *test act*, directs all officers civil and military to take the oaths and make the declaration against transubstantiation, in any of the king's courts at Westminster, or at the quarter sessions, within six calendar months after their admission; and also within the same time to receive the sacrament of the Lord's supper, according to the usage of the church of England, in some public church immediately after divine service and sermon, and to deliver into court a certificate thereof signed by the minister and church warden, and also to prove the same by two credible witnesses; upon forfeiture of 500l. and disability to hold the said office. And of much the same nature with these is the statute 7 Jac. I. c. 2. which permits no persons to be naturalized or restored in blood, but such as undergo a like test; which test having been removed in 1753, in favour of the Jews, was the next session of parliament restored again with some precipitation.

Non-

Non-Naturals, in *Medicine*, so called, because by their abuse they become the causes of diseases.

Physicians have divided the non-naturals into six classes, viz. the air, meats and drinks, sleep and watching, motion and rest, the passions of the mind, the retentions and excretions. See Medicine, *passim*.

Non-Obstante (*notwithstanding*) a clause frequent n statutes and letters patent, importing a license from the king to do a thing, which at common law might be lawfully done, but being restrained by act of parliament cannot be done without such license.

Non-Pros. See Nolle *Prosequi.*

Non-Suit, signifies the dropping of a suit or action, or a renouncing thereof by the plaintiff or defendant; which happens most commonly upon the discovery of some error in the plaintiff's proceedings when the cause is so far proceeded in, that the jury is ready at the bar to deliver in their verdict.

NONES, (nonæ), in the Roman kalendar, the fifth day of the months January, February, April, June, August, September, November, and December; and the seventh of March, May, July, and October. March, May, July, and October, had six days in their nones; because these alone, in the ancient constitution of the year by Numa, had 31 days a-piece, the rest having only 29, and February 30: but when Cæsar reformed the year, and made other months contain 31 days, he did not allot them six days of nones.

NONJURORS, those who refused to take the oaths to government, and who were in consequence under certain incapacities, and liable to certain severe penalties. It can scarcely be said that there are any nonjurors now in the kingdom; and it is well known that all penalties have been removed both from Papists and Protestants, formerly of that denomination, as well in Scotland as in England. The members of the Episcopal church of Scotland have long been denominated Nonjurors; but perhaps they are now called so improperly, as the ground of their difference from the establishment is more on account of ecclesiastical than political principles.

NONIUS, Peter, in Spanish *Nunez*, a learned Portuguese, and one of the ablest mathematicians of the 16th century, was born at Alcacer. He was preceptor to Don Henry, King Emmanuel's son, and taught mathematics in the university of Coimbra. He published the following works, by which he gained great reputation: 1. *De arte Navigandi*. 2. *Annotationes in theorias planetarum Purbachii;* which are greatly esteemed. 3. A treatise *De Crepusculis*. 4. A treatise on Algebra. It is observed in Furetiere's dictionary, that Peter Nonius in 1530, first invented the angles of 45 degrees made in every meridian, and that he called them *rhumbs* in his language, and calculated them by spherical triangles. Nonius died in 1577, aged 80.

Nonius, the name which was not many years ago given to the common device for subdividing the arcs of quadrants and other astronomical instruments, from the persuasion that it was invented by *Nonius* or *Nunez*, of whom some account has been given in the preceding article. The generality of astronomers of the present age, transferring the honour of the invention from *Nunez* to *Peter Vernier*, a native of Franche Comte, have called this method of division by his name. (See Vernier). Mr Adams, however, in his *Geometrical and Geographical Essays*, has lately shown that Clevius the Jesuit may dispute the invention with them both. The truth seems to be, that Nunez started the idea, Clevius improved it, and Vernier carried it to its present state of perfection. The method of Nunez, described in his treatise *De Crepusculis*, printed at Lisbon 1542, consists in describing within the same quadrant 45 concentric circles, dividing the outermost into 90 equal parts, the next within into 89, the next into 88, &c. till the innermost was divided into 46 only. On a quadrant thus divided the plumb line or index must cross one or other of the circles very near a point of division; whence, by computation, the degrees and minutes of the arch might be easily ascertained. This method is also described by Nunez in his treatise *De arte atque ratione Navigandi*, where he would fain persuade himself, that it was not unknown to Ptolemy. But as the degrees are thus divided very unequally, and as it is very difficult to attain exactness in the division, especially when the numbers into which the arches are to be divided are incomposite (of which there are no less than nine), the method of diagonals, first published by Thomas Digges, Esq. in a treatise entitled *Alæ seu scalæ mathematicæ*, printed at London in 1573, and said to be invented by one Richard Chenseler, was substituted in its room. Nonius's method was, however, improved at different times and by different persons; and it must be acknowledged, that if Vernier saw either the original or any of the improvements (and there can be little doubt of his having seen them all), his merit is only that of having applied to an useful practical purpose the speculative invention of another person.

NONNUS, a Greek poet of the 5th century, and native of Panopilis in Egypt, was the author of an heroic poem in 48 books, entitled *Dionysiacorum*, and a paraphrase in verse of St John's Gospel, which may serve as a commentary upon it.

NONUPLA, in the Italian music, denotes a quick time, peculiar to jigs. This species of time is otherwise called *the measure of nine times*, which requires two falls of the hand, and one rise. There are three sorts of nonupla. 1. *Nonupla di semi minime*, or *dupla sesquiquarta*, thus marked $\frac{9}{4}$, where nine crotchets are to be in the bar, of which four make a semibreve in common time, i. e. in the down stroke six, and but three up: it is usually beat *adagio*. 2. *Nonupla di crome*, or *sesqui ottava*, marked thus $\frac{9}{8}$, wherein nine quavers make a bar instead of eight in common time, i. e. six down and three up: it is beat *presto*. 3. *Nonupla di semicrome* or *super setti partiente nona*, thus distinguished $\frac{9}{16}$, in which nine semiquavers are contained in a bar, whereof sixteen are required in common time, six down, and three up: it is ordinarily beat *prestissimo*. Besides these, there are two other species of nonupla, for which see Triple.

NOOTKA sound, or, as it was called by Captain Cook, *King George's Sound*, lies in N. Lat. 49. 33. W. Long. 127. 12. It is an entrance or strait to a vast inland sea on the west coast of North America, and is said to resemble the Baltic or Mediterranean in Europe. Upon the sea-coast the land is tolerably high and level; but within the sound it rises into steep hills, which have an uniform appearance. The trees of which the woods are composed, are the Canadian pine, white cypress, Nootka Sound.

cypress, and two or three other sorts of pine. In general, the trees grow here with great vigour, and are of a large size. About the rocks and borders of the woods were seen some strawberry plants, and raspberry, currant, and gooseberry bushes, all in a flourishing state. The principal animals seen here were racoons, martens, and squirrels. Birds are far from being numerous, and those that are to be seen are remarkably shy, owing perhaps to their being continually harassed by the natives, either to eat them, or to become possessed of their feathers to be worn as ornaments. The quebrantahuessos, shags, and gulls, were seen off the coast; and the two last were also frequent in the sound. Though the variety of fish is not very great, yet they are in greater quantities than birds. The principal sorts are the common herring, a silver coloured bream, and another of a brown colour. Captain Cook and Mr King, who visited this place, consider it as an excellent shelter for ships: and in the account of *A Voyage to the Pacific Ocean*, they give some directions for sailing into it. These and other matters of that kind we shall not trouble our readers with; and perhaps the generality of them will be better pleased with the following extract from Meares's Voyages to the Northwest Coast of America.

"The people of the Nootka nation are, in general, robust and well-proportioned:—their faces are large and full, their cheeks high and prominent, with small black eyes:—their noses are broad and flat, their lips thick, and they have generally very fine teeth, and of the most brilliant whiteness.

"The manner in which the children of Nootka are treated, when young, is not more extraordinary from its strange, and, as it should appear, total inutility, than from its agreement with the customs of the Chinese and Tartars, to whom this practice gives these people a considerable resemblance. The head of the infant is bound by the mother with a kind of fillet of several folds, as low down as the eyes, in order to give it a certain form, which, at this tender age, it is capable of receiving. It might be supposed, that such a tight drawn ligature must cause considerable pain to the child; but we never observed that any of the infants, in such a state of preparation for sugar-loaf heads, suffered any visible pain or inconvenience.

"Though the custom of compressing the head in this manner gives them an unpleasant appearance, by drawing up the eyebrows, and sometimes producing the disagreeable effect of squinting, as well as of flattening the nose and distending the nostrils, they are by no means an ill-looking race of people. They have also the custom, which is known to prevail in so many Indian nations, of plucking out the beard by the roots, on its first appearance; and, as it continues to sprout, to keep it down by the same practice. It is one of the domestic employments assigned to their wives, to watch this appearance of manhood, and to eradicate the hairs as they come forth; which they do in a very dexterous manner with their fingers, and without giving the least pain in the operation.—Soon of them, however, though we saw but very few of this disposition, when they advance in years and become infirm, suffer their beards to grow without interruption. But, notwithstanding they have so great an aversion to the hair of their chin, that of the head is an object of their attentive vanity: it is strong, black, and glossy; grows to a considerable length; and is either tied in a kind of knot on the top of their heads, or suffered to hang down their backs in flowing negligence.

"In their exterior form they have not the symmetry or elegance which is found in many other Indian nations.—Their limbs, though stout and athletic, are crooked and ill-shaped; their skin, when cleansed of filth and ochre, is white; and we have seen some of the women, when in a state of cleanliness (which, however, was by no means a common sight, and obtained with difficulty), who not only possessed the fair complexion of Europe, but features that would have attracted notice, for their delicacy and beauty, in those parts of the world where the qualities of the human form are best understood. But these examples of beauty are by no means numerous among the women of Nootka, who are calculated rather to disgust than to charm an European beholder. Their hair, like that of the men, is black; their eyes are of the same colour; and, in exterior appearance, they are not to be immediately distinguished from the men. In their characters they are reserved and chaste; and examples of loose and immodest conduct were very rare among them. There were women in St George's Sound, whom no offers could tempt to meretricious submissions."

All reports concerning Nootka Sound agree in characterizing the inhabitants as "a very inoffensive race of people."—Inoffensive, however, as they are, a custom of a very unnatural, and we should imagine cruel, kind prevails among them; for, together with many other articles which they exposed to sale to Captain Cook's ships, they brought human skulls and hands (part of the flesh still remaining on them), which they acknowledged they had been feeding on; and some of them, we are told, had evident marks of the fire.

From hence it is too apparent, that the horrid practice of devouring their enemies exists here as well as at New Zealand and other South sea islands: and hence, too, appears what men of even the best natural dispositions will be, if left entirely to the freedom of their own will, without law to controul or religion to instruct them. As there are but two villages of the Sound inhabited, the number of people cannot be many; perhaps they are about 2000 in all. Our limits prevent us from being so minute as we could wish to be, respecting the form of their houses and their manner of building them; of their furniture, decorations, and other things of that kind: we can therefore only refer those who wish for further information on this subject to Cook, and other voyagers and travellers, &c.

The employment of the men is chiefly fishing, &c. whilst the women manufacture their garments. Their ingenuity in this and in the mechanic arts is far from being inconsiderable; and in the imitative arts their skill is very great. On these subjects, however, we cannot enlarge: we have in general made it our business, and it certainly is our duty, to dwell, where it can be done, on the manners or religion of the inhabitants of the several places which come under our notice; and they who know the utility of this in developing the philosophy of the human mind, the most important of all sciences, will not blame our intentions, even if they should not approve of the execution. In Cook's

Nootka Sound

Cook's Voyages before referred to, we find the following observations on the religion and language of the inhabitants of Nootka Sound.

"Little knowledge we can be supposed to have acquired of the political and religious institutions established among these people. We discovered, however, that there were such men as chiefs, distinguished by the title of *Acweek*, to whom the others are, in some degree, subordinate. But the authority of each of these great men seems to extend no farther than to his own family, who acknowledge him as their head. As they were not all elderly men, it is possible this title may be hereditary.

"Nothing that we saw could give us any insight into their notions of religion, except the figures already mentioned, called *Klumma*. These, perhaps, were idols; but as the word *acweek* was frequently mentioned when they spoke of them, we may suppose them to be the images of some of their ancestors, whose memories they venerate. This, however, is all conjecture; for we could receive no information concerning them; knowing little more of their language than to enable us to ask the names of things, and being incapable of holding any conversation with the natives relative to their traditions or their institutions.

"Their language is neither harsh nor disagreeable, farther than proceeds from their pronouncing the *k* and *h* with less softness than we do. As to the composition of their language, we are enabled to say but little. It may, however, be inferred from their slow and distinct method of speaking, that it has few prepositions or conjunctions, and is destitute of even a single interjection to express surprise or admiration. The affinity it may bear to other languages, we have not been able sufficiently to trace, not having proper specimens to compare it with; but from the few Mexican words we have procured, there is an obvious agreement throughout the language, in the frequent terminations of the words in *l*, *tl* or *z*.

"The word *wakash* was frequently in the mouths of the people of Nootka. It seemed to express approbation, applause, and friendship. Whenever they appeared to be pleased or satisfied at any sight or occurrence, they would call out *wakash! wakash!*—It is worthy of remark, that as these people do essentially differ from the natives of the islands in the Pacific ocean, in their persons, customs, and language, we cannot suppose their respective progenitors to have belonged to the same tribe, when they emigrated into those places where we now find their descendants."

We cannot finish this article without taking notice of a circumstance, which at the time made a great noise in Europe, and which it is probable will find a place in the future histories of the contending countries.

A small association of British merchants resident in the East Indies had, early in the year 1786, formed the project of opening a trade to this part of the world, for the purpose of supplying the Chinese market with furs. The principal point towards which these expeditions were directed, was Port Nootka, or King George's Sound; and the adventurers, being in some degree satisfied with their traffic, took measures, in the year 1788, to secure to themselves a permanent settlement; at the same time that the shipping employed in this expedition was generally two, and never exceeded the amount of four, small vessels. The Spaniards conceived some jealousy of the intrusion of the English into a part of the world which they had long been desirous to regard as their exclusive property; and accordingly a Spanish frigate of 26 guns was despatched from the province of Mexico, for the purpose of putting an end to this commerce. The Spanish frigate arrived in May 1789, and captured two English vessels in the following July, at the same time taking possession of the little settlement which had been formed upon the coast. Such, in short, is the circumstance which was likely to involve us in an expensive war. Happily, however, for both countries, and perhaps for Europe, the matter was at length, after great altercation, amicably settled; and it must still be so fresh in the memories of our readers, that we trust they will excuse us from enlarging further upon it—the whole article having extended perhaps to more than a sufficient length.

Nootka Sound || Nordheim.

NOPAL, RAQUETTE, or *Indian fig;* plants so named by the Indians, on which the cochineal insect breeds in Mexico. See COCHINEAL, DYEING *Index*.

NOPALXOCHQUETZALLI, or NOPALCOCHQUETZALLI, the prickly pear of Mexico, which is common over all the West Indies. See CACTUS, BOTANY *Index*.

NOPH. See MEMPHIS.

NORBURY, a town of Staffordshire, in England, on the south-west side of Eccleshall. Here is a surprising echo, which, taken 440 yards north-east from the manor house, near a little bank under a wood side, repeats in a still day 10 or 11 syllables very distinctly, or 12 or 13, if spoke very quick. It is remarked that the banks of the Black Meer, in this parish, grow forward every year over the surface of the water at the rate of three or four yards every seven years.

NORDEN, FREDERIC LEWIS, an ingenious traveller and naval officer in the Danish service, was born at Gluckstadt in Holstein in the year 1708. He was well skilled in mathematics, ship-building, and especially in architecture; and in 1732 obtained a pension to enable him to travel for the purpose of studying the construction of ships, particularly the galleys and other rowing vessels used in the Mediterranean. He spent near three years in Italy: and Christian VI. being desirous of obtaining a circumstantial account of Egypt, Mr Norden while at Florence received an order to extend his travels to that country. How he acquitted himself in this commission, appears from his Travels into Egypt and Nubia, printed at Copenhagen in folio, 1756; and which were soon after translated into English by Dr Peter Templeman. In the war between England and Spain, Mr Norden, then a captain in the Danish navy, attended Count Ulric Adolphus, a sea captain, to England; and they went out volunteers under Sir John Norris, and afterwards under Sir Chaloner Ogle. During his stay in London, Mr Norden was made a fellow of the Royal Scoiety, and gave the public drawings of some ruins and colossal statues at Thebes in Egypt, with an account of the same in a letter to the Royal Society, 1741. His health at this time was declining; and taking a tour to France, he died at Paris in 1742.

NORDHEIM, a town in Germany, in the Hanover quarter. Of the four larger towns of this principality, it is the third in order. It is situated on the Ruhme,

Ruhme, which runs into the Leine. It contains 500 houses, and, besides a secularized Lutheran abbey, has one parish church, some charitable foundations, and also some manufactures. E. Long. 9. 58. N. Lat. 51. 40.

NORES, JASON DE, a scholar, poet, and philosopher, was born at Nicosia in Cyprus. He lost his fortune when the Turks made themselves masters of that island in 1570. He retired to Padua; where he acquired great reputation by teaching moral philosophy. His character had that cast of severity which is often the consequence of scholastic habits. He was one of those men who discuss every thing without being capable of feeling any thing. The *Pastor Fido* of Guarini made its appearance; and pastorals became a fashionable species of reading throughout all Italy. Nores, who did not relish works of this kind, attacked the production of Guarini; who entirely confuted him in a little piece printed at Ferrara in 1588. Nores made a reply two years after; and the poet was preparing an answer still more severe than the former, when his antagonist died of grief, occasioned by the banishment of his only son for having killed a Venetian in a duel. He left behind him a great many works, some in Italian, and others in Latin. The chief of his Italian works, are, 1. The Poeticks, Padua, 1588, 4to; this edition is rare. 2. A Treatise on Republics, 1578, 4to; which he forms on the model of that of the Venetians, his masters. 3. A Treatise on the World and its Parts, Venice, 1571, 8vo. 4. Introduction to three books of Aristotle's Rhetoric, Venice, 1548, 4to, valuable. 5. A Treatise on what Comedy, Tragedy, and Epic Poetry, may receive from Moral Philosophy. His Latin works are, 1. *Institutio in Philosophiam Ciceronis*, Padua, 1576, 8vo. 2. *Brevis et distincta summa præceptorum de arte discendi, ex libris Ciceronis collecta*, Venice, 1553, 8vo; a good work. 3. *De Constitutione partium humanæ et civilis philosophiæ*, 4to. 4. *Interpretatio in artem poeticam Horatii*, &c. In all his works we remark great perspicuity and accuracy, profound erudition, happy expressions, an elevated and sometimes forcible style.—His son Peter Nores, successively secretary to several cardinals, at once a man of letters and a man of business, left behind him different manuscripts; among others, the life of Paul IV. in Italian.

NORFOLK, a county of England, so called from its northern situation in respect of Suffolk, is bounded on the east and north by the German ocean; on the south by Suffolk, from which it is parted by the rivers Waveney and the Lesser Ouse; and on the west it is separated from Cambridgeshire by the Greater Ouse, and from a small part of Lincolnshire by the Washes. According to Templeman, it extends in length 57 miles, in breadth 35, and 140 in circumference. It contains an area of 1426 square miles, one city, 32 market towns, 711 villages. In 1811 it contained 52,807 houses, and 291,999 inhabitants, of whom 100,410 were in towns, and 191,589 in the country. It is divided into 31 hundreds, 164 vicarages, and 660 parishes.

The air differs in different parts of the county according to the soil, which in some places is marshy, especially on the sea coast, and there the air is foggy and unwholesome; in others it is clayey and chalky, poor, lean, and sandy, and there the air is good. The county is almost all champaign, except in some places, where rise gentle hills. The marsh lands yield rich pasture for cattle; the clay grounds pease, rye, and barley; and the sandy heaths feed vast flocks of large sheep, of which some villages are said to keep 4000 or 5000. These heaths abound also in rabbits of a silver gray colour. Walsingham is noted for producing the best saffron. Great quantities of mackarel and herring are caught upon the coasts of this county, the former in the spring, and the latter in September; especially at Yarmouth, where they are cured in a particular manner, and to great perfection. Wood and honey are also very plentiful in this county; and on the coasts jet and ambergrease are sometimes found. The inhabitants are generally strong and active, sagacious and acute. That they are so robust, is the more to be wondered at, because the common people live much on puddings, *Norfolk dumplings*. They are for the most part in easy circumstances, and were formerly very quarrelsome and litigious. In consequence of this disposition, lawyers swarmed among them to such a degree, that a statute was made so early as the reign of Henry VI. to restrain their number. The manufactures of the county, which is exceedingly populous, are chiefly woollen and worsted stuffs and stockings, for which they are well supplied with wool from the vast flocks of sheep bred in it. It gives title of duke to the elder branch of the family of Howard, lies in the diocese of Norwich, and sends twelve members to parliament, viz. two knights for the shire, two citizens for Norwich, and two burgesses for each of the boroughs of Lynn Regis, Great Yarmouth, Thetford, and Castle-rising.

The county is well watered, and supplied with fish by the rivers Yare, Thyrn, Waveney, the Greater and Lesser Ouse, and the Bure, besides rivulets. The Bure abounds in excellent perch, and the Yare has a fish peculiar to it called the *ruffe*. The latter rises about the middle of the county; and after being joined by the Waveney and Bure, falls into the sea at Yarmouth. At the equinoxes, especially the autumnal, the Ouse is subject to great inundations, being forced back by the sea, that enters it with great fury. See NORFOLK, SUPPLEMENT.

NORFOLK, the most considerable seaport in the state of Virginia in North America. It is situated on the east side of Elizabeth river, which flows into the Chesapeake, and has an excellent harbour. It is well built, with wide paved streets, running in right lines, and contained in 1817 about 10,000 inhabitants, of whom one third were slaves. W. Long. 76. 10. N. Lat. 36. 5.

NORFOLK Island, a small island of the South sea, lying in 29° 12′ 30″ south latitude, and 168° 16′ east longitude. A colony was lately settled on it; and the following account of it is given in *Governor Philips's Voyage to Botany Bay*, &c.

"Norfolk island is about seven leagues in circumference; and if not originally formed, like many other small islands, by the eruption of volcanic matter from the bed of the sea, must doubtless have contained a volcano. This conclusion is formed from the vast quantity of pumice stone which is scattered in all parts of it, and mixed with the soil. The crater, or at least some traces of its former existence, will probably be found at the summit of a small mountain, which rises

Norfolk Island.

rises near the middle of the island. To this mountain the commandant has given the name of *Mount Pitt*. The island is exceedingly well watered. At or near Mount Pitt rises a strong and copious stream, which flowing through a very fine valley, divides itself into several branches, each of which retains sufficient force to be used in turning mills; and in various parts of the island springs have been discovered.

"The climate is pure, salubrious, and delightful; preserved from oppressive heats by constant breezes from the sea, and of so mild a temperature throughout the winter, that vegetation continues there without interruption, one crop succeeding another. Refreshing showers from time to time maintain perpetual verdure: not indeed of grass, for none has yet been seen upon the island; but of the trees, shrubs, and other vegetables, which in all parts grow abundantly. On the leaves of these, and of some kinds in particular, the sheep, hogs, and goats, not only live, but thrive and fatten very much. To the salubrity of the air every individual in this little colony can bear ample testimony, from the uninterrupted state of good health which has been in general enjoyed.

"When our settlers landed, there was not a single acre clear of wood in the island, and the trees were so bound together by that kind of creeping shrub called *supple jack*, interwoven in all directions, as to render it very difficult to penetrate far among them. The commandant, small as his numbers were at first, by indefatigable activity, soon caused a space to be cleared sufficient for the requisite accommodations, and for the production of esculent vegetables of all kinds in the greatest abundance. When the last accounts arrived, three acres of barley were in a very thriving state, and ground was prepared to receive rice and Indian corn. In the wheat there had been a disappointment, the grain that was sown having been so much injured by the weevil as to be unfit for vegetation. But the people were all at that time in commodious houses; and, according to the declarations of Mr King himself, in his letters to Governor Philip, there was not a doubt that this colony would be in a situation to support itself entirely without assistance in less than four years; and with very little in the intermediate time. Even two years would be more than sufficient for this purpose, could a proper supply of black cattle be sent.

"Fish are caught in great plenty, and in the proper season very fine turtle. The woods are inhabited by innumerable tribes of birds, many of them very gay in plumage. The most useful are pigeons, which are very numerous; and a bird not unlike the Guinea fowl, except in colour (being chiefly white), both of which were at first so tame as to suffer themselves to be taken by hand. Of plants that afford vegetables for the table, the chief are cabbage palm, the wild plantain, the fern tree, a kind of wild spinage, and a tree which produces a diminutive fruit, bearing some resemblance to a currant. This, it is hoped, by transplanting and care, will be much improved in size and flavour.

"But the productions which give the greatest importance to Norfolk Island are the pines and the flax plant; the former rising to a size and perfection unknown in other places, and promising the most valuable supply of masts and spars for our navy in the East Indies; the latter not less estimable for the purposes of making sailcloth, cordage, and even the finest manufactures, growing in great plenty, and with such luxuriance as to attain the height of eight feet. The pines measure frequently 160, or even 180 feet in height, and are sometimes 9 or 10 feet in diameter at the bottom of the trunk. They rise to about 80 feet without a branch; the wood is said to be of the best quality, almost as light as that of the best Norway masts; and the turpentine obtained from it is remarkable for purity and whiteness. The fern tree is found also of a great height for its species, measuring from 70 to 80 feet, and affords excellent food for the sheep and other small cattle. A plant producing pepper, and supposed to be the true oriental pepper, has been discovered lately in the island, growing in great plenty; and specimens have been sent to England in order to ascertain this important point."

Norfolk Island ‖ Noria.

Norfolk Sound, according to the account of Captain George Dixon, is situated in 57° 3′ north latitude, and 135° 36′ west longitude. It is a very extensive place, but how far it stretches to the northward is not known. There may possibly be a passage through to the Bay of Islands, but neither is this certain. The shore, in common with the rest of the coast, abounds with pines; there are also great quantities of the witch hazel. There are various kinds of flowering trees and shrubs, wild goosberries, currants, and raspberries; and parsley is found here in great plenty, and it eats excellently either as a salad or boiled amongst soup. The saranne, or wild lily root, grows also in great plenty and perfection. There are a very few wild geese or ducks seen here, but they are shy and difficult of approach.

NORHAM, a town in England, in the county of Northumberland, on the river Tweed, near the mouth of the Till, under the castle, which was anciently erected on a steep rock moated round, for the better security against the incursions of the Scotch moss troopers. It is of great antiquity; and its old church has lately received repairs, and been made a decent place of worship. Antiquities have been discovered here. The church had the privilege of a sanctuary. The castle has been frequently honoured with the presence of sovereigns, particularly Edward I. here received the oath of treaty from John Baliol of Scotland. It has been a formidable structure, a great part of which is in ruins; the site of which, with its demesnes, consisted of 1030 acres.

NORIA, a hydraulic machine much used in Spain. It consists of a vertical wheel of 20 feet diameter, on the circumference of which are fixed a number of little boxes or square buckets, for the purpose of raising the water out of the well, communicating with the canal below, and to empty it into a reservoir above, placed by the side of the wheel. The buckets have a lateral orifice to receive and to discharge the water. The axis of this wheel is embraced by four small beams, crossing each other at right angles tapering at the extremities, and forming eight little arms. This wheel is near the centre of the horse walk contiguous to the vertical axis, into the top of which the horse beam is fixed: but near the bottom it is embraced by four little beams, forming eight arms similar to those above described, on the axis of the water wheel. As the mule which they use goes round,

round, these horizontal arms, supplying the place of cogs, take hold, each in succession, of those arms which are fixed on the axis of the water wheel, and keep it in rotation.

This machine, than which nothing can be cheaper, throws up a great quantity of water; yet undoubtedly it has two defects: the first is, that part of the water runs out of the buckets and falls back into the well after it has been raised nearly to the level of the reservoir: the second is, that a considerable proportion of the water to be discharged is raised higher than the reservoir, and falls into it only at the moment when the bucket is at the highest point of the circle, and ready to descend.

Both these defects might be remedied with ease, by leaving these square buckets open at one end, making them swing on a pivot fixed a little above their centre of gravity, and placing the trough of the reservoir in such a position as to stop their progress whilst perpendicular; make them turn upon their pivot, and so discharge their contents.

From the reservoir the water is conveyed by channels to every part of the garden; these have divisions and subdivisions on beds, lome large, others very small, separated from each other by little channels, into which a boy with his shovel or his hoe directs the water, first into the most distant trenches, and successively to all the rest, till all the beds and trenches have been either covered or filled with water.

Mr Townsend, from whom we have taken the above account, thinks, that on account of the extreme simplicity of this machine, it is an invention of the most remote antiquity. By means of it the inhabitants every morning draw as much water from the well as will serve through the day, and in the evening distribute it to every quarter according to the nature of their crops. The reservoirs into which they raise the water are about 20, 30, or even 40 feet square, and three feet high above the surface of the ground, with a stone cope on the wall, declining to the water, for the women to wash and beat their clothes upon.

Our limits preclude us from following Mr Townsend farther in the description of a particular noria used at Barcelona; which he conceives to be the original chain pump, or at least its patent. He compares it with similar instruments, and shows its advantages and disadvantages.

NORICUM (Ptolemy, Tacitus); a Roman province, situated between the Danube on the north, and thus separated from ancient Germany; the Alpes Noricæ on the south; the river Ænus on the west, which separates it from Vindelicia; and Mons Cetius on the east, which divides it from Pannonia. Now containing a great part of Austria, all Saltzburg, Stiria, and Carinthia. It was anciently a kingdom under its own kings (Cæsar, Velleius, Suetonius). *Norici* the people, subdued by Tiberius under Augustus, as allies of the Pannonii (Dio, Velleius). Tacitus reckons Noricum among those provinces which were governed by procurators, officers sent by the emperors to receive and dispose of the public revenue according to order. It was divided into two provinces, but at what time uncertain; supposed as low down as Dioclesian and Constantine: *viz.* the *Noricum Ripense*, running along the south side of the Danube; and the *Noricum Mediterraneum*, extending towards the Alps. How far each of these extended in breadth does not appear: all the account we have of the matter being from Sextus Rufus, and the *Notitia Imperii Occidentalis*. Anciently a country famous for its iron and steel (Horace); as is Stiria at this day, a part of Noricum. A climate cold and more sparingly fruitful (Solinus).

NORIN, a river which rises in a corner of the Venetian confines, that runs between the rugged marble hills, and is left entirely to itself from its very source; hence a vast tract of land is overflowed by it, and encumbered with reeds, willows, and wild alders. A small space of ground only remains dry between the roots of the hills and the marsh at a place called *Prud*, and that is all covered with pieces of ancient hewn stones, fragments of inscriptions, columns, and capitals, and bass reliefs of the best age, worn and deformed by time, and the barbarism of the northern people, who begun on that side to destroy Narona. The inhabitants, who go often to cut reeds in the marsh, assert, that the vestiges of that large city may still be seen under water. It appears to have been extended over the plain a great way, and undoubtedly it was three miles in length at the foot of the hills. The ancient road is now under water; and it is necessary to ascend a very steep road, in order to pass the point of a craggy hill, on which, probably before the Roman times, those fortifications were erected that coast Vetinius so much labour.

NORIS, Henry, cardinal, a great ornament of the order of the monks of St Augustine, was descended from the president Jason, or James de Noris, and was born at Verona 1631. He was carefully educated by his father Alexander Noris, originally of Ireland, and well known by his history of Germany. He discovered from his infancy an excellent understanding, great vivacity, and a quick apprehension. His father instructed him in the rudiments of grammar, and procured an able professor of Verona, called *Massoleim*, to be his preceptor. At 15 he was admitted a pensioner in the Jesuits college at Rimini, where he studied philosophy; after which he applied himself to the writings of the fathers of the church, particularly those of St Augustine: and taking the habit in the convent of the Augustine monks of Rimini, he distinguished himself among that fraternity in a short time by his erudition: insomuch, that as soon as he was out of his noviciate or time of probation, the general of the order sent for him to Rome, in order to give him an opportunity of improving himself in the more solid branches of learning. He did not disappoint his superior's expectations. He gave himself up entirely to his study, and spent whole days, and even nights, in the library of the Angeliques of St Augustine. His constant course was to stick to his books 14 hours a day; and this course he continued till he became a cardinal. By this means he became qualified to instruct others; and on this errand he was first sent to Pezaro, and thence to Perousa, where he took his degree of doctor of divinity; after which, proceeding to Padua, he applied himself to finish his History of Pelagianism. He had begun it at Rome at the age of 26; and, having completed his design, the book was printed at Florence, and published in 1673. The great duke of Tuscany invited him the following year

to

Noris, Norkoping

to that city, made him his chaplain, and professor of ecclesiastical history in the university of Pisa, which his highness had founded with that view.

In his history he set forth and defended the condemnation pronounced, in the eighth general council, against Origen and Mopsuesta, the first authors of the Pelagian errors: he also added an account of the Schism of Aquileia, and a Vindication of the Books written by St Augustine against the Pelagians and Semi-Pelagians. The work had procured him a great reputation, but met with several antagonists, to whom he published proper answers: the dispute grew warm, and was carried before the sovereign tribunal of the inquisition. There the history was examined with the utmost rigour, and the author dismissed without the least censure. It was reprinted twice afterwards, and Mr Noris honoured by Pope Clement X. with the title of Qualificator of the Holy Office. Notwithstanding this, the charge was renewed against the Pelagian History, and it was dilated afresh before the inquisition in 1676; but it came out again with the same success as at first. Mr Noris was now suffered to remain in peace for sixteen years, and taught ecclesiastical history at Pisa, without any molestation, till he was called to Rome by Innocent XII. who made him under-librarian of the Vatican in 1692. This post was the way to a cardinal's hat; his accusers, therefore, took fresh fire, and published several new pieces against him. Hence the Pope appointed some learned divines, who had the character of having taken neither side, to re-examine Father Noris's books, and make their report of them. Their testimony was so advantageous to the author, that his holiness made him counsellor of the inquisition. Yet neither did this hinder one of his adversaries, the most formidable on account of his erudition, to rise up against him, and attack him warmly, under the assumed title of a *Scrupulous Doctor of the Sorbonne.* Noris tried to remove these scruples in a work which appeared in 1695, under the title of An Historical Dissertation concerning one of the Trinity that suffered in the Flesh; wherein, having justified the monks of Scythia, who made use of that expression, he vindicated himself also from the imputation of having attainted the Pope's infallibility, of having abused Vincentius Lirinensis, and other bishops of Gaul, as favourers of Semi-Pelagianism, and of having himself gone into the errors of the bishop of Ypres.

His answers to all these accusations were so much to the satisfaction of the pope, that at length his holiness honoured him with the purple in 1695. After this, he was in all the congregations, and employed in the most important affairs; so that he had little time to spend in his study, a thing of which he frequently complained to his friends. Upon the death of Cardinal Casanati, he was made chief library keeper of the Vatican in 1700; and two years afterwards nominated, among others, to reform the kalendar: but he died at Rome in 1704 of a dropsy. He was one of the most learned men in the last century; his writings abound with erudition, and are very elegantly finished. He was a member of the Academy; whence he assumed the name of Eucrates Agoretico. His works are numerous, and were published at Verona, in 1729 and 1730, in five volumes folio.

NORKOPING, a town of Sweden, in the province of East Gothland, in east longitude 15° 30′, latitude 58° 20.′ Its name signifies "the northern market," in the Swedish language. It stands on the banks of a large river called *Motala*, which coming from the lake *Vetter*, falls a little lower into a gulf called *Brawicken*. It is the largest and most populous town in Sweden, next to Stockholm, conveniently situated near the sea on a navigable river, which brings large vsssels up to the middle of the town. There are some handsome streets, and the houses in general are neatly built. Some of the churches are worth seeing; but the greatest curiosity are the famous copper mines, where there is a vast number of people constantly at work. In this article the town carries on a very good trade; as also in several other manufactures, as leather, steel, and guns, which they make the best in Sweden.

Norkoping, Normandy

It covers a large space of ground, being ten miles in circumference; but the houses are small and scattered, and the inhabitants do not exceed 10,000. The river Motala flows through the town, forms a series of cataracts, and is divided into four principal streams, which encircle several rocky islands, covered with houses and manufactories. At the extremity of the town it is navigable for small vessels. Several manufactories are established in the town; 55 fabrics of cloth, which employ 1500 men; 3 sugar-houses; 1 of snuff; 50 mills for grinding corn, which is exported in large quantities; and a brass foundery. A salmon fishery gives employment and riches to many of the inhabitants.

NORMANDY, a province of France, bounded on the north by the English channel; on the east by Picardy and the Isle of France; on the south by Perche and Maine, and one part of Bretagne; and on the west by the ocean. It is about 155 miles in length, 85 in breadth, and 600 in circumference. It includes nearly the whole of the departments of Lamanche, Calvados, Orne, Eure, and Seine Inferior. It abounds in all things except wine, but they supply that defect by cyder and perry. There are vast meadows, fat pastures, and the sea yields plenty of fish. It contains iron, copper, and a great number of rivers and harbours. It carries on a great trade, is very populous, and comprehends a vast number of towns and villages. It is divided into the Upper and Lower; the Upper borders upon Picardy, and the Lower upon Bretagne. It contains seven dioceses or bishoprics, Rouen, Bayeux, Avranches, Evreux, Sées, Lisieux, and Coutances, in which they compute 4189 parishes, and 80 abbeys. The inhabitants are ingenious, and capable of understanding any arts and sciences, but they are chiefly fond of law. The Normans, a people of Denmark and Norway, having entered France under Rollo, Charles the Simple ceded this country to them in 912, which from that time was called *Normandy*, and contains about 8200 square miles. Its chief city is Rouen. Rollo was the first duke, and held it as a fief of the crown of France, and several of his successors after him, till William, the seventh duke, conquered England in 1066: from which time it became a province of England, till it was lost in the reign of King John, and reunited to the crown of France; but the English still keep the islands on the coast.

The principal rivers are the Seine, the Eure, the Aure, the Iton, the Dive, the Andelle, the Rille, the Touque, the Drômec, and the Orne: among the sea ports, the principal are those of Dieppe, Havre, Honfleur, Cherburg, and Granville. Rouen is the principal city.

NORMANS, a fierce warlike people of Norway, Denmark, and other parts of Scandinavia. They at different times overran and ravaged most countries in Europe: to the respective histories of those countries we therefore refer for a fuller account of them, as it is impossible to enlarge upon particulars in this place without repeating what has been already said, or may be said, in different parts of this work.

Norman Characters, a species of writing introduced into England by William I. From some old manuscripts the Norman writing appears to have been composed of letters nearly Lombardic. In regal grants, charters, public instruments, and law proceedings, this character was used with very little variation from the reign of the Conqueror to that of Edward III. See Writing.

NORRIS, or Noris. See Noris.

NORTH, one of the four cardinal points of the world; being that point of the horizon which is directly opposite to the sun in meridian. The north wind is generally accompanied with a considerable degree of cold. It sometimes blows with almost irresistible fury. It is often mentioned by the classic authors under the name of *Boreas*, which is of Greek original. See Boreas.

North Pole. See Pole.

North, *Dudley*, *Lord*, the third baron of that accomplished family, was one of the finest gentlemen in the court of King James; but in supporting that character, dissipated and gamed away the greatest part of his fortune. In 1645, he appears to have acted with the parliament; and was nominated by them to be administrator of the admiralty, in conjunction with the great earls of Northumberland, Essex, Warwick, and others. He lived to the age of 85, the latter part of which he passed in retirement; and wrote a small folio of miscellanies, in prose and verse, under this title, A Forest promiscuous of several Seasons Productions, in four parts, 1659.

North, *Dudley*, *Lord*, son of the former, was made knight of the Bath in 1616, at the creation of Charles prince of Wales; and sat in many parliaments, till excluded by the prevailing party in that which condemned the king. From that period Lord North lived privately in the country, and towards the end of his life entertained himself with books, and, as his numerous issue required, with economy; on which he wrote a little tract, called *Observations and advices economical*, 12mo. His other works are, Passages relating to the long parliament; the history of the life of Lord Edward North, the first baron of the family, addressed to his eldest son; and a volume of Essays.

North, *Francis*, *Lord Guildford*, lord-keeper of the great seal in the reigns of Charles II. and James II. was a third son of the second Dudley lord North, baron of Kertling; and studied at St John's college in Cambridge, from whence he removed to the Middle Temple. He acquired French, Italian, Spanish, and Dutch; and became not only a good lawyer, but was well versed in history, mathematics, philosophy, and music. He was afterwards made the king's solicitor-general, and was chosen to represent the borough of Lynn in parliament. He succeeded Sir Heneage Finch in the post of attorney-general; and Lord Chief-Justice Vaughan, in the place of lord chief-justice of the common pleas. He was afterwards made keeper of the great seal; and in 1683 was created a baron by the title of *Lord Guildford*. He died at his house at Wroxton in 1685. He wrote a philosophical essay on music; a paper on the gravitation of fluids, considered in the bladders of fishes, printed in Lowthorp's abridgement of the Philosophical Transactions; and some other pieces.

North, Right Honourable *Frederick*, earl of Guildford, Lord North, lord warden and admiral of the Cinque Ports, governor of Dover castle, lord lieutenant and custos rotulorum of Somersetshire, chancellor of the university of Oxford, recorder of Gloucester and Taunton, an elder brother of the Trinity house, president of the Foundling hospital and of the Asylum, a governor of the Turkey Company and of the Charter house, K.G. and LL. D. was born April 13. 1732; and married, May 20. 1756, Miss Ann Speke, an heiress of the ancient family of Dillington in Somersetshire, by whom he has left two sons and three daughters: the eldest son George Augustus, born September 11. 1759, and married, September 30. 1785, to Miss Hobart, succeeds to the earldom and estates. The late earl succeeded his father August 4. 1790. His lordship succeeded the celebrated Mr Charles Townsend as manager of the house of commons and chancellor of the exchequer; and in 1770, on the resignation of the duke of Grafton, was made first lord of the treasury; in which office he continued until the close of the American war, or rather until the formation of the Rockingham ministry, which began the business of peace with the colonies. He was a man of strong mental faculties; and as an orator, at once commanded attention and enforced conviction: but taking the helm at a time when the king's party were unpopular, and when it was supposed that the late earl of Bute was the great machine by which the cabinet was moved, he continued in that state of unpopularity until he resigned the seals. During the whole of his premiership (and to conduct the helm at that time required uncommonly great abilities) he studiously avoided imposing any taxes that should materially affect the lower class of people. The luxuries, and not the necessaries, of life were repeated objects of his budget. As a financier, he stood high, even in the opinion of opposition; and they were a combination of all the great talents in the kingdom: but, fatally wedded to the destructive plan of subduing the republican spirit of the Americans, his administration will not only stand marked in the page of history with an immense waste of public treasure, but it will appear besprinkled with the kindred blood of thousands of British subjects. To the very last moment he spoke in the senate, however, he defended that war; and said, he was then, as he was formerly, prepared to meet the minutest investigation as to his conduct in that business; which nothing but the unforeseen intervention of France could have prevented from being crowned with success. His lordship was one of the firmest and most strenuous supporters of the constitution in church and state. He died on the 5th of August 1792. His recollection he retained to his last moments: his family, except Lord North, who came within a few minutes afterwards, were assembled round his bed, and he took leave of them individually. Their grief did not suffer them to leave the room for some time after the event;

event; and Lady Caroline Douglas was at last forced from it. Even Dr Warren, who must be strengthened as far as habit can operate against nature to endure such scenes, ran from this, convulsed with sorrow. If any extent of sympathy can lessen affliction, this family may find such relief; for perhaps no man was ever more generally beloved by all who had access to him than the earl of Guildford.

We may form an opinion of the estimation the celebrated university of Oxford entertained of their chancellor while living, by the very great honour they paid to his remains. About five o'clock in the afternoon of the 15th, the great bell at St Mary's church at Oxford rang out, which was a signal that the funeral procession had arrived in the environs of that city. The officers of the university, and the whole body of resident students, were previously assembled in Magdalen College, in order to pay some tribute to the memory of their deceased chancellor. They joined the procession at Magdalen Bridge, and paraded on foot before the herse up the high street to Carfax; from thence down the corn market to St Giles's church at the town's end, in a most solemn manner. Here they halted, and opening to the right and left, the herse and other carriages passed through, the whole university being uncovered. The herse and attendants then proceeded to Banbury, where his lordship's remains were deposited in the family vault.

North Cape, the most northerly promontory in Europe, on the coast of Norway. E. Long. 21. 0. N. Lat. 78. 0.

North Ferry, a small village, on the north side of the frith of Forth, at the Queen's Ferry passage. There was here formerly a chapel, served by the monks of Dunfermline, and endowed by Robert I. Near it are large whinstone quarries, which partly supply London with paving stones, and employ many vessels for the conveyance. "The granite (whinstone) (Mr Pennant says) lies in perpendicular strata, and above is a reddish earth, filled with micaceous friable nodules."

North Foreland, a cape or promontory of Kent, in the isle of Thanet, four miles east of Margate. Between this and the South Foreland are the Downs, through which all ships pass that are bound to or from the west. E. Long. 1. 25. N. Lat. 51. 25.

North-West Passage, a passage to the Pacific ocean through Hudson's bay or Davis's straits, and which hath been frequently attempted without success; notwithstanding which, many people are still of opinion that it is practicable.

The idea of a passage to the East Indies by the north pole, or through some opening near to it, was suggested as early as the year 1527. The person who had the honour to conceive this idea was Robert Thorne, a merchant of Bristol, who addressed two papers on the subject, the one to King Henry VIII. the other to Dr Ley, ambassador from that monarch to the emperor Charles V. To remove any objection to the undertaking, which might be drawn from the supposed danger, he insists, in his address to the king, upon the great advantages of constant daylight in the polar seas, and the probability of the climate being in those regions temperate during the summer months. In the paper addressed to Dr Ley, he observes that cosmographers may as probably be mistaken in the opinion which they entertain of the polar regions being impassable from extreme cold, as it has been found they were in supposing the countries under the line to be uninhabitable from excessive heat.

The possibility of the passage was, in consequence of these addresses, very generally supposed; and in 1557, Sir Martin Forbisher sailed to 62° north latitude, where he discovered the straits which have since borne his name. In 1577, Barne, in a book entitled the *Regiment of the Sea*, mentions a north-west passage as one of the five ways to Cathay; and dwells on the mildness of the climate, which, from the constant presence of the sun during summer, he imagines must be found near the pole. In 1578, George Best, a gentleman who had been with Sir Martin Forbisher in his voyages of discovery, wrote a very ingenious discourse to prove all parts of the world habitable. It does not, however, appear that any voyage was undertaken, for the express purpose of attempting to sail to India in a north-west direction, till the year 1607; when Henry Hudson was sent, at the expence of some merchants in London to discover a passage by the north pole to Japan and China. He sailed from Gravesend on the 1st of May, and on the 21st of June fell in with the land to the westward, in latitude 73°, which he named *Hold-with-hope*. On the 27th he discovered Spitsbergen, and met with much ice. The highest latitude in which he made an observation was 80° 27′. See Hudson.

In March 1609, Jones Poole was sent by Sir Thomas Smith, and the rest of the Muscovy Company, to make further discoveries towards the north pole. After great severity of weather, and much difficulty from ice, he made the south part of Spitsbergen on the 16th of May; and sailing along and sounding the coast, he made many accurate discoveries; but was not in that voyage able to proceed beyond 79° 50′. He was again employed (1611), in a small vessel called the *Elizabeth*, to attempt the north-west passage; but after surmounting numberless difficulties, and penetrating to 80° of latitude, he lost his ship at Spitsbergen. Two voyages, equally unsuccessful, were made in 1614 and 1615, by Baffin and Fotherby; the latter of whom concludes the account of his discoveries and dangers, with exhorting the company which employed him not to adventure more than 150l. or 200l. at most on yearly voyages to these seas.

Hitherto nothing had been done in this great undertaking but by private adventurers, fitted out for the double purpose of discovery and present advantage; and the polar regions were suffered to remain unexplored in that direction, from the year 1615 till 1773, when the earl of Sandwich, in consequence of an application which had been made to him by the Royal Society, laid before his majesty a proposal for an expedition to try how far navigation is practicable towards the north pole. Upon receiving this proposal, his majesty was pleased to direct that the voyage should be immediately undertaken, with every assistance that could contribute to its success. Accordingly, the Racehorse and Carcass bombs were fitted out for the purpose, and the command of the expedition given to Captain Phipps, now Lord Mulgrave. His Lordship's instructions were to proceed up to the pole, or as far towards it as possible, and as nearly upon a meridian as the ice or other obstructions should admit; and during the course of the voyage, to make such observa-

North-west Passage.

tions of every kind as might be useful to navigation, or tend to the promotion of natural knowledge. A very accurate account of this voyage was published by his Lordship in 1774. He had, by exerting all the powers of a skilful and intrepid seaman, forced his way, on the 1st of August, to 80° 37′; but could proceed no farther, as he was there opposed by one continued plain of smooth unbroken ice, bounded only by the horizon.

Many other attempts have been made to discover this passage, by sailing along the western coast of America; but hitherto none of them has been crowned with success. So early as 1579, Sir Francis Drake assured Queen Elizabeth that he had sailed some leagues up the straits of Anian (see ANIAN), and discovered New Albion, to the north of California; but the strait is now known to have no existence; and Drake's real discoveries were not improved. In 1638, King Charles I. sent Captain Luke Fox in one of his pinnaces to attempt the passage; but of his proceedings we know nothing, but that he reached Port Nelson in Hudson's bay, where he found some remains of former navigators. Next year Captain James was fitted out by the merchants of Bristol for the same purpose. James was one of the ablest navigators that ever sailed from England or any other country; and his voyages to the north were printed in 1633. After all the experiments he had made, he concluded that there was no such passage; or if there be, he affirmed that the discovery of it would not be attended with those advantages which are commonly expected. His reasons, however, for these opinions have been answered, and many subsequent attempts have been made to perform what he thought impossible. The arguments for a north-west passage were so plausible, that in 1744, an act of parliament was passed to encourage the discovery of it. Among many others, Captain Cook attempted the discovery in vain, and thence adopted James's opinion. (See *COOKE's Discoveries*, N° 103.). This celebrated navigator, after having proceeded northwards to the western extremity of America, and ascertained the proximity of the two great continents of Asia and America, returned to the Sandwich islands, firmly persuaded of the impracticability of a passage in that hemisphere from the Atlantic into the Pacific ocean, either by an eastern or a western course.

An attempt was made by Vancouver between the years 1790 and 1795; but the result of this voyage renders the existence of such a passage still more doubtful.

The last attempt to discover this passage was made in 1818. The two ships employed, the Isabella, Captain Ross, and the Alexander, Lieutenant Parry, sailed from the Thames on the 18th April. They reached Cape Dudley Diggs on the 17th August, and afterwards passed Smith's sound and Whale sound, but found the coast in many parts unapproachable from ice. Jones's sound was explored, but no appearance of a passage found. From this they followed the line of the coast southward till they came, on the 30th August, to Lancaster sound, which at first presented appearances favourable to their hopes, but on examination land was found to extend across its bottom. Several other inlets were observed, but all blocked up with ice. The sea was generally of great depth, and the coast mountainous; and where bays occurred they were still backed by high land. On the 1st October they reached Cumberland strait, which, from the current at its entrance, afforded, in Captain Ross's opinion, a better chance of a passage than any other place; but their instructions and the lateness of the season would not allow them to explore it. The expedition arrived at Shetland on the 30th October, having coasted the whole of Baffin's bay, but generally at a considerable distance from the shore, without discovering the passage sought. It appears also, from Captain Ross's journal, that the supposed current setting southward from the bay, which was one chief reason for inferring the reality of the passage, does not exist. Since Captain Ross's return, however, strong objections have been raised to the accuracy of his survey in some points; and for this and other reasons, a new expedition is preparing, with the view of exploring the coast more minutely at those points where a passage is conceived to be most probable. A party is also to proceed by land from the north-western lakes of Canada, to ascertain the position of the coast towards the bay. It is highly probable, therefore, that the question will soon be set at rest. But what is known already shows that, were the passage discovered, the navigation can scarcely be at any time practicable, and the subject is no farther of importance than as it would settle a point in geography.

North-west Passage, North-east Passage.

NORTH-East Passage, a passage to the East Indies along the northern coasts of Asia, which, like the former, hath frequently been attempted, but hitherto without success. The first attempt was made in 1553, by Sir Hugh Willoughby, who commanded three ships. He departed from the Thames, and sailed to the North Cape, where one of his ships left him, and returned home. The other two ships being separated, Sir Hugh proceeded farther northward, and discovered that part of Greenland which the Dutch have since called *Spitzberg*: but the severity of the cold obliging him to return to the southward, he was forced, by bad weather, into the river Arzina, in Muscovite Lapland, where, not being able to come out, he was found the next spring frozen to death, with all his ship's company; having the notes of his voyage and his last will lying before him, whereby it appeared that he lived till January. But Richard Chancellor, in the third ship, with better success, in the meanwhile entered Wardhuys, where he waited some time for his companions to no purpose; uncertain whether they were lost, or driven farther by stress of weather. He held a council on what he should do; whether to return, or pursue his voyage. Whatever danger might be in the last, every one agreed to it, that they might not seem to have less courage than their captain. They therefore set sail, and in a few days found themselves in a sea where they could no longer perceive any night. This ship, wandering about, entered soon after into a large bay or gulf. Here they cast anchor, in sight of land; and while they were examining the coast, they discovered a fishing boat. Chancellor getting into his sloop, went towards it; but the fishermen took to flight. He followed, and, overtaking them, showed them such civilities as conciliated their affections to him; and they carried him to the place where now is the famous port of St Michael the Archangel. These people immediately spread through all the coasts an account of the arrival of those strangers; and people came from several parts to see them, and ask them questions. They, in their turn, examined the others, and found

found that the country they were in was Russia, governed by the mighty emperor John Basilowitz. Chancellor from Archangel travelled on sledges to the Czar at Moscow; from whom, overjoyed at the prospect of opening a maritime commerce with Europe, he obtained privileges for the English merchants, and letters to King Edward VI. who was not, however, alive to receive them.

In 1585, Mr John Davis in two barks discovered Cape Desolation, which is supposed to be part of Greenland; and two years after advanced as far as Lat. 72°, where he discovered the strait which still bears his name. To enumerate all the attempts which have been made to discover a north-east passage, would swell the article to very little purpose. The English, Dutch, and Danes, have all attempted it without success. The last voyage from England for this purpose was made in 1676, under the patronage of the duke of York. That unfortunate prince, who was on all occasions earnest for the promotion of commerce, and the Lord Berkeley, &c. fitted out a ship, commanded by Captain Wood, for an attempt once more to find a north-east passage to India, accompanied with a ship of the king's. They were encouraged to this attempt, after it had been so long despaired of, by several new reports and reasonings: some of which seem not to have been very well grounded—As,

"1. On the coast of Corea, near Japan, whales had been found with English and Dutch harpoons sticking in them. This is no infallible proof that ships could get thither by a north-east passage, although whales might.

"2. That, 20 years before, some Dutchmen had sailed within one degree of the north pole, and found it temperate weather there: and that therefore William Barents, the Dutch navigator who wintered at Nova Zembla in the year 1596, should have sailed further to the north before turning eastward; in which case, said they, he would not have found so much obstruction from the ice.

"3. That two Dutch ships had lately sailed 300 leagues to the eastward of Nova Zembla; but their East India Company had stifled that design, as against their interest:—and such like other airy reports. But this attempt proved very unfortunate. They doubled the North Cape, and came among much ice and drift wood, in 76° of north latitude, steering to the coast of Nova Zembla, where the king's ship struck upon the rocks, and was soon beat to pieces; and Captain Wood returned home with an opinion, "that such a passage was utterly impracticable, and that Nova Zembla is a part of the continent of Greenland."

These passages, however, are not yet deemed impracticable by all. The count de Buffon holds it for certain, that there is such a passage; and he thinks, that if any farther attempts be made to discover a passage to China by the north, it will be necessary to steer directly towards the pole; and to explore the most open seas, where unquestionably, says he, there is little or no ice. This opinion has been revived by the honourable Daines Barrington. See *North Pole*.

NORTHALLERTON, a borough town of England, though not incorporated, in the north riding of Yorkshire. It sends two members to parliament. The population in 1811 was 2234. In 1138, the Scots army under King David was defeated by the English near this town. It is 34 miles S. from Durham, and 223 N. from London.

NORTHAMPTON, a town in England, capital of a county of the same name, situated in W. Long. 0. 55. N. Lat. 52. 15. According to Camden, it was formerly called *North-afandon*, from its situation to the north of the river Nen, called anciently *Aufona*, by which and another lesser river it is almost enclosed. Dr Gibson says, that the ancient Saxon annals called both it and Southampton simply *Hampton;* and afterwards, to distinguish them, called the one, from its situation, *Southampton*, and the other *Northampton;* but never *North-afandon*. Though it does not appear to be a place of very great antiquity, nor to have emerged from obscurity till after the Conquest, it has sent members to parliament since the reign of Edward I. and being in the heart of the kingdom, several parliaments have been held at it. There was also a castle, and a church dedicated to St Andrew, built by Simon de Sancto Licio, commonly called *Senlez*, the first earl of Northampton of that name. It is said to have been burnt down during the Danish depredations; but in the reign of St Edward it appears to have been a considerable place. It was besieged by the barons in their war with King John; at which time that military work called *Hunshill*, is supposed to have been raised. In the time of Henry III. it sided with the barons, when it was besieged and taken by the king. Here the bloody battle was fought in which Henry VI. was taken prisoner. It was entirely consumed by a most dreadful fire in 1675; yet, by the help of liberal contributions from all parts of the country, it hath so recovered itself, that it is now one of the neatest and best built towns of the kingdom. Among the public buildings, which are all lofty, the most remarkable are the church called *All-hallows* (which stands at the meeting of four spacious streets), the sessions and assize house, and the George inn, which belongs to the poor of the town. A county hospital or infirmary has been lately built here, after the manner of those of Bath, London, Bristol, &c. It has a considerable manufacture of shoes and stockings; and its fairs are noted for horses both for draught and saddle; besides, it is a great thoroughfare for the north and west roads. It was formerly walled, and had seven churches within and two without. The horse market is reckoned to exceed all others in the kingdom, it being deemed the centre of all its horse markets and horse fairs, both for saddle and harness, and the chief rendezvous of the jockies both from York and London. Its principal manufacture is shoes, of which great numbers are sent beyond sea; and the next to that, stockings and lace, as we have hinted at above. It is the richer and more populous, by being a thoroughfare both in the north and west roads; but, being 80 miles from the sea, it can have no commerce by navigation. The walls of this town were above two miles in compass. The number of inhabitants in 1811 was 8427. It had formerly a nunnery in the neighbouring meadows, with several other monasteries; and of its very old castle on the west side of the town, a small part of the ruins is still to be seen. Some discontented scholars came hither from Oxford and Cambridge, about the end of the reign of Henry III. and, with the king's leave, prosecuted their studies here academically for three years; during which there was the face of an university, till it was put a stop to by express prohibition, because it was a damage to both universities. The public horse races are on a neighbouring down, called *Pey-Leys*. In and about the town are abundance of cherry gardens. Within half a mile of the town is one of the crosses erected by King Edward I. in memory of his queen Eleanor, whose corpse was rested there in its way to Westminster. On the north side of the river, near that cross, many Roman coins have been ploughed up. At Guilesborough, north-west of Northampton, are to be seen the vestiges of a Roman camp, the situation of which is the more remarkable, as lying between the Nen and the Avon, the only pass from the north to the south parts of England not intercepted by any river. This camp was secured only by a single intrenchment, which was, however, very broad and deep.

NORTHAMPTONSHIRE, a county of England, is situated in the very heart of the kingdom: bounded on the east by the counties of Bedford and Huntingdon; on the south by those of Buckingham and Oxford; on the west by Warwickshire; and on the north by the counties of Leicester, Rutland, and Lincoln, which are separated from it by the Lesser Avon, and the Welland. Its greatest length is about 50 miles, its greatest breadth about 20, and its circumference about 130. It includes 336 parishes, one city, eleven market towns; and in 1811 contained 28,857 houses, and 141,353 inhabitants, of whom 34,741 live in towns, and 106,612 in the country. Nine members are returned to parliament for this county, viz. two knights for the shire, two for the city of Peterborough, two for each of the towns of Northampton and Brockly, and one for Higham Ferrers. It lies in the midland circuit, and in the diocese of Peterborough. As this county is dry, well cultivated, free from marshes, except the fens about Peterborough, in the centre of the kingdom, and of course at a distance from the sea, it enjoys a very pure and wholesome air. In consequence of this, it is very populous, and so full of towns and churches, that 30 spires or steeples may be seen in many places at one view; and even in the fens the inhabitants seem to enjoy a good state of health, and to be little affected by the water which frequently overflows their grounds, especially in winter, but is never suffered to remain long upon it. Its soil is exceeding fertile both in corn and pasturage; but it labours under a scarcity of fuel, as it doth not produce much wood, and by lying at a distance from the sea, cannot be easily supplied with coal. Its commodities, besides corn, are sheep, wool, black cattle, and saltpetre; and its manufactures are serges, tammies, shalloons, boots, and shoes. Besides many lesser brooks and streams, it is well watered by the rivers Nen, Welland, Ouse, and Lerm; the three first of which are large, and for the most part navigable. See NORTHAMPTONSHIRE, SUPPLEMENT.

NORTH ROCKS (otherwise called *St Patrick's rocks*, from a seat of stone amongst them called *St Patrick's chair*, whence the rocks have taken this second name); situated in the harbour of Donaghadee, in the county of Down, and province of Ulster, in Ireland. From north to south they are about two-thirds of a league, between which is clean good ground. But care must be taken of the south rock, on which many ships have perished: for it is overflowed by every tide, and no crew can save their lives if the wind blows high. This rock stands a full mile from the shore.

NORTH SEA. See *North Sea*.

NORTHERN LIGHTS, the same with AURORA BOREALIS, under which article we have given a copious account of this phenomenon, and of the supposed causes of it. Natural science, however, does not arrive at perfection at once, and it is well if it does so after trials repeated for years with care and accuracy. How far the causes that have been assigned for this appearance will account for it, or whether they will be able to remove all difficulties, it is not for us to determine; but it is the part of philosophers to hear all sides, and to attend with patient assiduity to every hypothesis, rejecting or receiving, as reason, after the strictest investigation, shall seem to favour the one side or the other. We shall here notice a hypothesis which Doctor Stearns, an American, formed, about the year 1788, to account for the appearances called *aurora borealis*, and *aurora australis*.

Doctor Stearns supposes that these phenomena originate from aqueous, nitrous, sulphureous, bituminous, and other exhalations, from the fumes of various kinds of earths or other minerals, vegetables, animals, fires, volcanoes, &c. These, he thinks, become rarefied, and being charged with electrical fluid, become specifically lighter than the circumambient air; hence, of course, they ascend; and being elevated to the upper regions of the air, and driven by the winds from warmer to colder climates, the cold makes them combine and stiffen. When they are afterwards agitated by different currents of air, they sparkle and crackle like the hairs of cats and other animals when stiffened with cold. This coruscation in quite cold atmospheres, and in those which are more temperate, appears in different positions in the horizon, zenith, or otherwise, according to the situation of the spectator, and the position of the elevated exhalations. The difference of colours the doctor supposes to arise from the different qualities of the articles combined, those of the most inflammable nature shining with the greatest lustre.

The doctor likewise tries to account for these lights not appearing, or but seldom appearing, in ancient times. The atmosphere, he thinks, was not impregnated with materials proper to produce them. He imagines that the increased consumption of fuel, in America in particular, the burning of volcanoes, and the approach of blazing stars, whose atmospheres have been so expanded by the sun's heat that part of them have fallen into the earth's atmosphere, and communicated to it new matter, have so changed and prepared our air, that whenever its consistence is proper, then, if the light of the sun and moon is not too powerful, the aurora borealis will appear.

NORTHUMBERLAND, the most northerly county of England, and formerly a distinct kingdom, is bounded on the north and west by the river Tweed, which divides it from Scotland, the Cheviot hills, and part of Cumberland; washed on the east by the German ocean; and separated from Durham on the south by the rivers Tyne and Derwent. This county, which gives

Northumberland. gives the title of *duke* to a nobleman, who married the daughter of Algernon duke of Somerset, whose mother was heiress of the Percy family, extends about 66 miles in length from north to south, and about 47 in breadth from east to west. It is remarkably populous, containing 12 market towns, 280 villages, and 460 parishes. The face of the country, especially towards the west, is roughened with huge mountains, the most remarkable of which are the Cheviot hills, and the high ridge called *Redesdale;* but the lands are level towards the sea side and the borders of Durham. The climate, like that of every other mountainous country in the neighbourhood of the sea, is moist and disagreeable: the air, however, is pure and healthy, as being well ventilated by breezes and strong gales of wind; and in winter mitigated by the warm vapours from the two seas, the Irish and the German ocean, between which it is situated. The soil varies in different parts of the county. Among the hills it is barren; though it affords good pasture for sheep, which cover those mountains. The low country, when properly cultivated, produces plenty of wheat, and all sorts of grain; and great part of it is laid out in meadow lands and rich enclosures. Northumberland is well watered with many rivers, rivulets, and fountains: its greatest rivers are the Tweed and the Tyne. The Tyne is composed of two streams called *South* and *North Tyne:* the first rises on the verge of Cumberland, near Alston moor; enters Northumberland, running north to Haltwhistle; then bends easterly, and receiving the two small rivers East and West Alon, unites above Hexham with the other branch, taking its rise at a mountain called *Fane-head* in the western part of the county, thence called *Tynedale;* is swelled in its course by the little river Shele; joins the Read near Billingham; and running in a direct line to the south-east, is united with the southern Tyne, forming a large river that washes Newcastle, and falls into the German ocean near Tynemouth.

In all probability the mountains of Northumberland contain lead ore and other mineralized metals in their bowels, as they in all respects resemble those parts of Wales and Scotland where lead mines have been found and prosecuted. Perhaps the inhabitants are diverted from inquiries of this nature, by the certain profits and constant employment they enjoy in working the coal pits, with which this county abounds. The city of London, and the greatest part of England, are supplied with fuel from these stores of Northumberland, which are inexhaustible, enrich the proprietors, and employ an incredible number of hands and shipping. About 658,858 chaldrons are annually shipped for London.

There are no natural woods of any consequence in this county; but many plantations belonging to the seats of noblemen and gentlemen, of which here is a great number. As for pot herbs, roots, salading, and every article of the kitchen garden and orchard, they are here raised in great plenty by the usual means of cultivation; as are also the fruits of more delicate flavour, such as the apricot, peach, and nectarine. The spontaneous fruits it produces in common with other parts of Great Britain, are the crab-apple, the sloe or bullace, the hazel nut, the acorn, hips, and haws, with the berries of the bramble, the juniper, wood strawberries, cranberries, and bilberries.

Northumberland raises a good number of excellent horses and black cattle, and affords pasture for numerous flocks of sheep; both the cattle and sheep are of a large breed, but the wool is coarser than that which the more southern counties produce. The hills and mountains abound with a variety of game, such as red deer, foxes, hares, rabbits, heathcock, grouse, partridge, quail, plover, teal, and woodcock: indeed, this is counted one of the best sporting counties in Great Britain. The sea and rivers are well stocked with fish; especially the Tweed, in which a vast number of salmon is caught and carried to Tynemouth, where being pickled, they are conveyed by sea to London, and sold under the name of *Newcastle salmon*.

The Northumbrians were anciently stigmatized as a savage, barbarous people, addicted to cruelty, and inured to rapine. The truth is, before the union of the two crowns of England and Scotland, the borders on each side were extremely licentious and ungovernable, trained up to war from their infancy, and habituated to plunder by the mutual incursions made into each kingdom; incursions which neither truce nor treaty could totally prevent. People of a pacific disposition, who proposed to earn their livelihood by agriculture, would not on any terms remain in a country exposed to the first violence of a bold and desperate enemy; therefore the lands lay uncultivated, and in a great measure deserted by every body but lawless adventurers, who subsisted by theft and rapine. There was a tract 50 miles in length and six in breadth, between Berwick and Carlisle, known by the name of the *debateable land*, to which both nations laid claim, though it belonged to neither; and this was occupied by a set of banditti who plundered on each side, and what they stole in one kingdom, they sold openly in the other: nay, they were so dexterous in their occupation, that by means of hot bread applied to the horns of the cattle which they stole, they twisted them in such a manner, that, when the right owners saw them in the market, they did not know their own property. Wardens were appointed to guard the marches or borders in each kingdom; and these offices were always conferred on noblemen of the first character for influence, valour, and integrity. The English border was divided into three marches, called the *east*, *west*, and *middle marches;* the gentlemen of the county were constituted deputy wardens, who held march courts, regulated the watches, disciplined the militia, and took measures for assembling them in arms at the first alarm: but in the time of peace between the two nations, they were chiefly employed in suppressing the insolence and rapine of the borderers. Since the union of the crowns, however, Northumberland is totally changed, both with respect to the improvement of the lands, and the reformation of the inhabitants. The grounds, being now secure from incursion and insult, are settled by creditable farmers, and cultivated like other parts of the kingdom. As hostilities have long ceased, the people have forgotten the use of arms; and exercise themselves in the more eligible avocations of peace, in breeding sheep and cattle, manuring the grounds, working at the coal pits, and in different branches of commerce and manufacture. In their persons they are generally tall, strong, bold, hardy, and fresh coloured; and though less unpolished than their ancestors, not quite so civilized as their southern

southern neighbours. The commonalty are well fed, lodged, and clothed; and all of them remarkably distinguished by a kind of *shibboleth* or *whurle*, being a particular way of pronouncing the letter R as if they hawked it up from the windpipe, like the cawing of rooks. In other respects, the language they speak is an uncouth mixture of the English and Scottish dialects. There is no material distinction between the fashionable people of Northumberland and those of the same rank in other parts of the kingdom; the same form of education will produce the same effects in all countries. The gentlemen of Northumberland, however, are distinguished for their industry, knowledge of rural affairs, and hospitality. The number of inhabitants in 1801 was reckoned at 157,101, and in 1811, 172,161.

A great number of Roman monuments have been found in this county; but the most remarkable are the remains of Hadrian's vallum and the wall of Severus. See *Adrian*, note (A), and *Severus's Wall*.

The most noted towns in Northumberland, are Newcastle, Morpeth, Alnwick, Berwick, Hexham, and North Shields. It sends two members to parliament. See Northumberland, Supplement.

NORTHWICK, a small town of Cheshire, long celebrated for its rock salt and brine pits. The stratum of salt lies about 40 yards deep; and some of the pits are hollowed into the form of a temple. The descent is through a dome, the roof supported by rows of pillars about two yards thick, and several in height; and when illuminated with a sufficient number of candles, they make a most magnificent appearance. Above the salt is a bed of whitish clay, (*Argilla cærula-cinerea*), used in making the Liverpool earthen ware; and in the same place is also dug a good deal of the gypsum, or plaster stone. The fossil salt is generally yellow and semipellucid, sometimes debased with a dull greenish earth; and is often found, but in small quantities, quite clear and colourless. The town is situated near the river Dane, and is tolerably handsome: it has a market on Fridays. Population in 1811, 1382. It is 20 miles north-east of Chester, and 173 north-west of London. W. Long. 2. 36. N. Lat. 53. 16.

NORTON, in Cheshire, a good modern alms-house, founded by P—y Brooke, Esq. on the site of a priory of canons regular of St Augustine, founded by William, son of Nigellus, A. D. 1135, who did not live to complete his design; for Eustace de Burgaville granted to Hugh de Catherine pasture for 100 sheep, in case he finished the church in all respects conformable to the intent of the founders. It was granted afterwards to R. Brooke, Esq.

NORTON'S SOUND, on the north-west coast of America, was discovered in Captain Cook's last voyage, and was so named in honour of Sir Fletcher Norton (Lord Grantley), a near relation of Mr afterwards Dr King. It extends as far as N. Lat. 64° 55′. There is no good station for ships, nor even a tolerable harbour in all the sound. Mr King, on his landing here, discerned many spacious valleys, with rivers flowing through them, well wooded, and bounded with hills of a moderate height. One of the rivers towards the north-west seemed to be considerable; and he was inclined to suppose, from its direction, that it discharged itself into the sea from the head of the bay. Some of his people, penetrating beyond this into the country, found the trees to be of a larger size the further they proceeded. E. Long. 197. 13. N. Lat. 64. 31.

NORWAY, a country of Europe (for the map see Denmark), lying between the 57th and 72d degrees of north latitude, and between the 5th and 31st degrees of longitude east from London; extending in length about 1000 miles, in a direct line from Lindefnaes, in the diocese of Christiansand, to the North Cape, at the extremity of Finmark. Its breadth, from the frontiers of Sweden westward to Cape Statt, may amount to about 300 miles; but from thence the country becomes gradually narrower towards the north. On the south it is bounded by the Schagen rock, or Categate, the entrance into the Baltic; on the east it is divided from Sweden by a long ridge of high mountains; and on the west and north it is washed by the northern ocean. In the southern part of Norway, the country is craggy, abrupt, and mountainous, diversified sometimes with fertile and even delightful spots. In these respects it resembles Switzerland: the prospects and the meteorological phenomena seem to be very similar. The range of the thermometer is of great extent; in the summer having risen to 88°, and in the winter fallen to —40°: in general it is between 80° and —22°.

Respecting the population of Norway it is difficult to attain to certainty. An author of some note (Coxe) seems to think it amounts to 750,000; but he appears to have over-rated it considerably.

The Norwegian peasants are free, well clothed, well lodged, spirited, active, frank, open, and undaunted. They are said to have a very considerable resemblance to the peasants of Switzerland. The soil is too thin for the plough: corn is therefore obtained from the neighbouring states; and the chief employment of the peasants of Norway is grazing. The following extract from Mr Coxe, being a description of the scene near Christiana, is not beside our purpose, and may not perhaps be disagreeable to our readers.

Coxe's Travels.

"As we approached Christiana, the country was more wild and hilly, but still very fertile and agreeable; and about two miles from the town we came to the top of a mountain, and burst upon as fine a view as ever I beheld. From the point on which we stood in raptures, the grounds laid out in rich enclosures, gradually sloped to the sea: below us appeared Christiana, situated at the extremity of an extensive and fertile valley, forming a semicircular bend along the shore of a most beautiful bay, which, being enclosed by hills, uplands, and forests, had the appearance of a large lake. Behind, before, and around, the inland mountains of Norway rose on mountains covered with dark forests of pines and fir, the inexhaustible riches of the north. The most distant summits were caped with eternal snow. From the glow of the atmosphere, the warmth of the weather, the variety of the productions, and the mild beauties of the adjacent scenery, I could scarcely believe that I was nearly in the 60th degree of northern latitude."

The coast of Norway, extending above 300 leagues, is studded with a multitude of small islands, affording habitation to fishermen and pilots, and pasture to a few cattle. They form an infinite number of narrow channels, and a natural barrier of rocks, which renders Norway inaccessible to the naval power of its enemies.

mies. Attempts of this kind are the more dangerous, as the shore is generally bold, steep, and impending; so that close to the rocks the depth of the sea amounts to 100, 200, or 300 fathoms. The perils of the north sea are moreover increased by sudden storms, sunk rocks, violent currents, and dreadful whirlpools. The most remarkable vortex on this coast is called *Moskoestrom*, from the small island Moskoe, belonging to the district of Lofoden in the province of Nordland. In time of flood, the stream runs up between Lofoden and Moskoe with the most boisterous rapidity; but in its ebb to the sea, it roars like a thousand cataracts, so as to be heard at the distance of many leagues. The surface exhibits different vortices; and if in one of these any ship or vessel is absorbed, it is whirled down to the bottom, and dashed in pieces against the rocks. These violent whirlpools continue without intervals, except for a quarter of an hour, at high and low water, in calm weather; for the boiling gradually returns as the flood or ebb advances. When its fury is heightened by a storm, no vessel ought to venture within a league of it. Whales have been frequently absorbed within the vortex, and howled and bellowed hideously in their fruitless endeavours to disengage themselves. A bear, in attempting to swim from Lofoden to Moskoe, was once hurried into this whirlpool, from whence he struggled in vain for deliverance, roaring so loud as to be heard on shore; but notwithstanding all his efforts, he was borne down and destroyed. Large trees being absorbed by the current are sucked down, and rise again all shattered into splinters. There are three vortices of the same kind near the islands of Ferroe.

Norway under the Danish government was divided into the four governments of Aggerhus, Bergen, Drontheim, and Wardhus, besides that of Bahus, which belonged to Sweden. The province of Aggerhus comprehends the south-east part of Norway, extending in length about 300 miles. Its chief towns are Christiana, the see of a bishop, suffragan to the metropolitan see of Drontheim, where the sovereign court of justice is held, in presence of the viceroy and the governor of the province; Aggerhus, about 15 miles to the south-west of Christiana; Frederickshall or Frederickstadt, in the siege of which Charles XII. of Sweden lost his life; Saltzberg, Tonsberg, Alleen, Hammar, and Hollen.

The government of Bergen lies in the most southerly and westerly part of Norway, including the city of the same name, which is an episcopal see, and a place of considerable trade; and Staffhanger, situated in the bay of Buckenfior, about 80 miles to the southward of Bergen. The third province, called *Drontheim* or *Trontheim*, extends about 500 miles along the coast; and is but thinly peopled. The chief town, Drontheim, seated on a little gulf at the mouth of the river Nider, is the only metropolitan see in Norway; and carries on a considerable trade in masts, deals, tar, copper, and iron. Leetstrand, Stronden, Scoerdale, Opdal, Romsdael, and Solendael, are likewise places of some traffic. The northern division of Drontheim, called the *sub-government of Salten*, comprehends the towns Melanger and Scheen. The province of Wardhus, extending to the North Cape, and including the islands, is divided into two parts; namely, Finmark and Norwegian Lapland. The chief town, which is very inconsiderable, stands upon an island called *Ward*, from whence the place and the government derive their name. The province of Bahus, though now yielded to the Swedes, is reckoned part of Norway, being a narrow tract of land, about 90 miles in length, lying on coast of the Categate.

The great chain of Norway mountains, running from north to south, called indifferently *Rudfield*, *Sudefield*, *Skarsfield*, and *Scoreberg*, is known in different parts by other appellations; such as *Dofrefield*, *Lamsfield*, *Sagnifield*, *Filefield*, *Halnefield*, *Hardangerfield*, *Joklefield*, *Byglefield*, *Hicklefield*, and *Hangfield*. The height and breadth of this extensive chain likewise vary in different parts. To pass the mountain Hardanger, a man must travel about 70 English miles, wheras Filefield may be about 50 over. This last rises about two miles and a half in perpendicular height; but Dofrefield is counted the highest mountain of Norway, if not of Europe. The river Drivane winds along the side of it in a serpentine course so as to be met nine times by those who travel the winter road to the other side of the chain. The bridges are thrown over roaring cataracts, and but indifferently fastened to the steep rocks on either side; so that the whole exhibits a very dreadful appearance, sufficient to deter the traveller from hazarding such a dangerous passage; for which reason, people generally choose the road over Filefield, which is much more tedious. This, however, is the post road used by the king's carriages. The way is distinguished by posts fixed at the distance of 200 paces from each other, that, in snowy or dark weather, the traveller may not be bewildered. For the convenience of resting and refreshing, there are two mountain stoves or houses maintained on Filefield, as well as upon other mountains, at the expence of the public, and furnished with fire, light, and kitchen utensils. Nothing can be more dismal and dreary than those mountains covered with eternal snow, where neither house, tree, nor living creature is to be seen, but here and there a solitary rein deer, and perchance a few wandering Laplanders.

In travelling from Sweden to Nordenfields, there is only one way of avoiding this chain of mountains; and that is, where it is interrupted by a long deep valley, extending from Romsdale to Guldbrandsdale. In the year 1612, a body of 1000 Scots, commanded by Sinclair, and sent over as auxiliaries to the Swedes, were put to the sword in this defile, by the peasants of Guldbrand, who never give quarter.

Besides this chain, there is a great number of detached mountains over all the country, that form valleys and ridges, inhabited by the peasants. Some of these are of incredible height, and others exhibit very remarkable appearances. In sailing up Joering Creek on the left hand, the sight is astonished with a group of mountains, resembling the prospect of a city, with old Gothic towers and edifices. In the parish of Oerskong is the high mountain Skopshorn, the top of which represents the figure of a fortification, with regular walls and bastions. In the district of Hilgeland appears a very high range of mountains, with seven pinnacles or crests, known by the appellation of the *Seven Sisters*, discernible a great way off at sea. To the southward of this range, though in the same district, rises the famous mountain *Torghatten*, so called because the summit resembles a man's head with a hat on, under which appears a single eye, formed by an aperture through the mountain, Norway. mountain, 150 ells high, and 3000 ells in length. The sun may be seen through this surprising cavity, which is passable by the foot of travellers. On the top of the mountain we find a reservoir of water, as large as a moderate fish pond: in the lower part is a cavern, through which a line 400 fathoms in length, being let down, did not reach the bottom. At Herroe in Sundmoer is another cavern called *Dolsteen*, supposed to reach under the sea to Scotland; which, however, is no more than an idle tradition. In the year 1750, two clergymen entered this subterranean cavity, and proceeded a considerable way, until they heard the sea dashing over their heads: the passage is as wide and high as an ordinary church, the sides perpendicular, and the roof vaulted. They descended one flight of natural stairs; but arriving at another, they were afraid to penetrate farther: they had gone so far, however, that two candles were consumed in their progress and return. A cavern of a very curious nature, serving as a conduit to a stream of water, penetrates through the sides of the mountain Limur. In the district of Rake, in the neighbourhood of Fredrickshall, are three cavities in a rock; one of which is so deep, that a small stone dropped down does not reach the bottom in less than two minutes; and then the sound it produces is pleasant and melodious, not unlike the sound of a bell.

The vast mountains and rugged rocks that deform the face of this country are productive of numberless inconveniences. They admit of little arable ground: they render the country in some parts impassable, and everywhere difficult to travellers: they afford shelter to wild beasts, which come from their lurking holes, and make terrible havock among the flocks of cattle: they expose the sheep and goats, as well as the peasants, to daily accidents of falling over precipices: they occasion sudden torrents, and falls of snow, which descend with incredible impetuosity, and often sweep away the labours of the husbandman; and they are subject to dreadful disruptions, by which huge rocks are rent from their sides, and, hurling down, overwhelm the plains below with inevitable ruin. The peasants frequently build their houses on the edge of a steep precipice, to which they must climb by ladders, at the hazard of their lives; and when a person dies, the corpse must be let down with ropes, before it can be laid in the coffin. In winter the mail is often drawn up the sides of steep mountains. Even in the king's road, travellers are exposed to the frequent risks of falling over those dreadful rocks; for they are obliged to pass over narrow pathways, without rails or rising on the sides, either shored up with rotten posts, or suspended by iron bolts fastened in the mountains. In the narrow pass of Naeroe is a remarkable way of this kind, which, above 600 years ago, the famous King Surre caused to be made for the passage of his cavalry; and even this would have been found impassable by any other horses than those of Norway, which are used to climb the rocks like goats. Another very difficult and dangerous road is that between Shogstadt and Vang-in-Volders, along the side of a steep mountain, in some places so narrow, that if two travellers on horseback should meet in the night, they would find it impracticable either to pass each other, or turn back. In such a case their lives could not be saved, unless one of them should alight, and throw his horse headlong into the lake below, and then cling to the rock, until the other could pass. When a sheep or goat makes a false step to the projection of a rock, from whence it can neither ascend nor descend, the owner hazards his own life to preserve that of the animal. He directs himself to be lowered down from the top of the mountain, sitting on a cross stick, tied to the end of a long rope; and when he arrives at the place where the creature stands, he fastens it to the same cord, and it is drawn up with himself. Perhaps the other end of the rope is held by one person only; and there are some instances in which the assistant has been dragged down by the weight of his friend, so that both have perished. When either man or beast has had the misfortune to fall over very high precipices, they have not only been suffocated by the repercussion of the air, but their bodies have been always burst before they reached the ground. Sometimes entire crests of rocks, many fathoms in length and breadth, have fallen down at once, creating such a violent agitation of the air, as seemed a prelude to the world's dissolution. At Steenbroe in Laerdale, a stupendous mass, larger than any castle in the universe, appears to have been severed and tumbled from the mountain in large, sharp, and ragged fragments, through which the river roars with hideous bellowing. In the year 1731, a promontory on Sundmoer, called *Rammersfield*, that hung over Nordal Creek, suddenly gave way, and plunged into the water; which swelled to such a degree, that the church of Strand, though half a league on the other side of the bank, was overflowed: the creek however was not filled up; on the contrary, the fishermen declare they find no difference in the depth, which is said to exceed 900 fathoms.

The remarkable rivers of Norway are these: The Nied, issuing from Tydalen, on the borders of Sweden, runs westward into the lake Selboe; and afterwards, turning to the northward, passes by the city of Drontheim, to which it anciently gave the name of *Nidcros* and *Nidrosia:* Sule Ely, that descending from Sulefield, runs with a rapid course through Nordale into the sea: Gulen, which rises near Sffarsfield in the north; and running 20 leagues westward, through Aalen, Hlotaalen, Storen, and Melhuus, discharges itself into the sea about a league to the west of Drontheim. In the year 1344, this river buried itself under ground: from whence it again burst forth with such violence, that the earth and stones thrown up by the eruption filled the valley, and formed a dam; which, however, was soon broken and washed away by the force of the water. Divers churches, 48 farm houses, with 250 persons, were destroyed on this occasion.—Otteroen, a large river, taking its rise from the mountain Agde, runs about 30 leagues through Seeterdale and Efie, and disembogues itself into the cataract of Wiland. The river Syre rises near the mountain Lang, and winds its course through the vale of Syre into the lake of Lunde in the diocese of Christiansand; thence it continues its way to the sea, into which it discharges itself through a narrow strait formed by two rocks. This contraction augments its impetuosity, so that it shoots like an arrow into the sea, in which it produces a very great agitation. Nid and Sheen are two considerable rivers, issuing out of Tillemark. Their water-falls have been diverted, with infinite labour, by canals and passages cut through the rocks, for the convenience of floating down the timber. Tyrefiord or Dramme, is in the neighbourhood of Honifosse,

nifosse, joined by two rivers from Oedale and Hadeland, and disembogues itself into the sea near Bragness. Loven rises in the highest part of Nummedal, and runs through Konsberg to the sea near Laurwig. Glaamen is the largest river of Norway, distinguished by the name of *Stor Elvin*, or the *great river*. It derives its origin from the mountain Dofre, from whence it winds all along the plains of Oesterdale and Soloe; then joins the Vorme, another considerable river rising out of Mioes and Guldbrandsdale. These being joined, traverse the lake Oeyern; and thence issuing, run on to Sarp near Frederickstadt.

Norway abounds with fresh-water lakes; the principal of which are Rysvand in Nordland, Snaasen, Selboe, the Greater and Lesser Mioes, Slirevand, Sperdille, Rand, Vestn, Saren, Modum, Lund, Norsoe, Huidsoe, Farisvand, and Oeyevand; all these are well stocked with fish, and navigable for large vessels. Wars have been formerly carried on upon these inland seas; in some of which are small floating islands, or parcels of earth, with trees on them, separated from the main land, and probably preserved in compact masses by the roots of trees, shrubs, and grass, interwoven in the soil. In the year 1702, the family seat of Borge, near Frederickstadt, being a noble edifice, with lofty towers and battlements, suddenly sunk into an abyss 100 fathoms deep, which was instantaneously filled by a piece of water 300 ells in length and about half as broad. Fourteen persons, with 200 head of cattle, perished in this catastrophe, which was occasioned by the river Glaamen precipitating itself down a water-fall near Sarp, and undermining the foundation. Of all the water-falls in Norway this of Sarp is the most dangerous for its height and rapidity. The current drives 17 mills; and roars with such violence, that the water, being dashed and comminuted among the rocks, rises in the form of rain, where a beautiful rainbow may be always seen when the sun shines. In ancient times this cataract was made use of for the execution of traitors and other malefactors: they were thrown down alive, that they might be dashed in pieces on the points of rocks, and die in a dreadful commotion, analogous to those they had endeavoured to excite in the community.

Great part of Norway is covered with forests of wood, which constitute the principal article of commerce in this country. They chiefly consist of fir and pine, for which great sums are received from foreigners, who export an immense number of masts, beams, planks, and boards. Besides, an incredible quantity is consumed at home in building houses, ships, bridges, piles, moles, and fences; over and above the vast demand for charcoal to the founderies, and fuel for domestic uses.—Nay, in some places, the trees are felled for no other purpose but to clear the ground, and to be burned into ashes for manure. A good quantity of timber is yearly exported from all parts of Norway; but the chief exports are from Drammen, Frederickshall or Frederickstadt, Christiana, Skeen, Arendal, Christiansand, Christian's Bay, and Drontheim. The masts and large beams are floated down the rivers, and the rest is divided into boards at the saw mills. These works supply a vast number of families with a comfortable subsistence.—A tenth part of all sawed timber belongs to his Danish majesty, and makes a considerable branch of his revenue. The forests in Norway are so vast and thick, that the people seem to think there can never be a scarcity of wood, especially as the soil is peculiarly adapted for the production of timber: they therefore destroy it with a wasteful hand; insomuch that more wood rots in Norway than is burned in the whole kingdom of Denmark. The best timber grows in the provinces of Saltan, Helleland, Romsdale, Guldbrandsdale, Oesterdale, Soloe, Valders, Hallingdale, Sognifiord, Tellemark, and the lordship of Nedenes.

The climate of Norway is very different in different parts of the kingdom. At Bergen the winter is so moderate, that the seas are always open and practicable both to mariners and fishermen, except in creeks and bays, that reach far up into the country towards Filefield, when the keen north-east wind blows from the land. On the east side of Norway, from the frontiers of Sweden to Filefield, the cold generally sets in about the middle of October with great severity, and lasts till the middle of April; during which interval the waters are frozen to a very considerable thickness, and the face of the country is covered with snow. In the year 1719, 7500 Swedes, who intended to attack Drontheim, perished in the snow on the mountain of Ruden or Tydel, which separates Jempteland in Sweden from the diocese of Drontheim. A company of 200 Norwegian sledgemen under Major Emahus, found them all frozen to death on the ridge of the mountain, where they had been overtaken by a storm accompanied with snow, hail, and extreme cold. Some of these unhappy victims appeared sitting, some lying, and others kneeling in a posture of praying. They had cut in pieces their muskets, and burned the little wood they afforded.—The generals Labarre and Zoega lost their lives; and of the whole corps, consisting originally of 10,000, no more than 2500 survived this dreadful catastrophe.

The cold is still more intense in that part of Norway called *Finmark*, situated in the frigid zone near the polar circle. But if the winter is generally cold, the summer is often excessively hot in Norway. The rays of the sun are reverberated from the sides of the mountains so as to render the weather close and sultry in the valleys; besides, the sun's absence below the horizon is so short, that the atmosphere and mountains have not time to cool. The heat is so great, that vegetation is remarkably quick. Barley is sown, grows, ripens, and is reaped, in the space of six weeks or two months. The longest day at Bergen consists of 19 hours; the sun rising at half an hour after two, and setting at half an hour after nine. The shortest day does not exceed six hours; for the sun rises at nine in the morning, and sets at three in the afternoon.—In the beginning of the year the daylight increases with remarkable celerity; and, at the approach of winter, decreases in the same proportion. In summer one may read and write at midnight by the light of the sky. Christian V. while he resided at Drontheim, used to sup at midnight without candles. In the district of Tromsen, at the extremity of Norway, the sun is continually in view at midsummer. It is seen to circulate day and night round the north pole, contracting its orbit, and then gradually enlarging it, until at length it leaves the horizon. In the depth of winter, therefore, it is for some weeks invisible; and all the light perceived at noon is a faint glimmering for about an hour and a half, proceeding from the reflection of the sun's rays from the highest mountains.

mountains. But the inhabitants of these provinces are supplied with other lights that enable them to follow their employments in the open air. The sky being generally serene, the moonshine is remarkably bright, and, being reflected from the mountains, illuminates the valleys. They are also assisted by the aurora borealis, which is very frequent in the northern parts of Europe.

The air of Norway is generally pure and salubrious. On the sea coasts, indeed, it is rendered moist by vapours and exhalations: but in the midland parts of the country, towards the mountains, the climate is so dry, that meal may be kept for many years without being worm-eaten or damaged in the least. The inhabitants have no idea of sickness, except what is occasioned by excesses. It is said, that in the vale of Guldbrand the inhabitants live to such extreme old age, that they become weary of life, and cause themselves to be removed to a less salubrious climate, whereby they may have a chance of dying the sooner. In consumptions, however, the moist air on the sea side is found to be most agreeable to the lungs in respiration. Norway, being a mountainous country intersected by creeks, abounding with lakes, rivers, and snow, must be subject to frequent rains; and from sudden thaws the inhabitants are sometimes exposed to terrible disasters. Vast masses of snow falling from precipices overwhelm men, cattle, boats, houses, nay even whole villages. About two centuries ago, a whole parish was covered and destroyed by an immense mass of snow; and several domestic utensils, as scissars, knives, and basons, have been at different times brought to light by a rivulet that runs under the snow, which has been gradually hardened and increased by repeated frosts and annual accessions.

The winds that chiefly prevail on the western coast are those that blow from the south; whereas, on the other side of Filefield, the winds that produce and continue the hard frosts are always northerly. In the summer, there is a kind of regular trade-wind on the coast of Bergen. In the forenoon the sea begins to be cooled with a westerly breeze, which continues till midnight. Then the land breeze begins from the east, and blows till about ten in the morning. The coast is likewise subject to sudden squalls and storms. Hurricanes sometimes rise at sea; and in these latitudes the phenomenon called a *water-spout* is not uncommon. One of these in the neighbourhood of Ferro is said to have sucked up with the water some lasts of herrings, which were afterwards dropped on Kolter, a mountain 1200 feet high.

The fresh water of Norway is not very light or pure; but on the contrary is generally turbid, and deposites a sediment of adventitious matter, being sometimes impregnated with ochre and particles of iron.—Nevertheless it is agreeable to the taste, and remarkably salubrious; as appears from the good health of the common people, who drink little or no other liquor.

The soil of Norway varies in different places according to the situation of rock or valley. The mountains, here, as in every other country, are bare and barren; but the earth washed down from them by the rains enriches and fertilizes the valleys. In these the soil generally consists of black mould, sand, loam, chalk, and gravel, lying over one another in unequal strata, and sometimes in three or four successions: the mould that lies uppermost is very fine and mellow, and fit to nourish all sorts of vegetables. There is also clay found in different parts of this kingdom, of which the inhabitants begin to make earthen ware; but bricks and tiles are not used in building. The face of the country is in many places deformed by large swamps and marshes, very dangerous to the traveller. Near Leessoe in the diocese of Christiansand, a wooden causeway is extended near a mile over a morass; and if a horse or any other animal should make a false step, he will sink at once into the abyss, never to rise again.

In a cold country like Norway, roughened with rocks and mountains, interspersed with bogs, and covered with forests, we cannot expect to find agriculture in perfection. The ploughed lands, in respect to mountains, woods, meadows, and wastes, do not exceed the proportion of 1 to 80; so that the whole country does not produce corn to maintain above half the number of its inhabitants. The peasants are discouraged from the practice of husbandry by the frequency of accidents that seem peculiar to the climate. Even in the fruitful provinces of Guldbrandsdale, Oesterdale, and Soloer, as well as in the other places, when the corn appears in the most flourishing condition, the whole hope of the harvest is sometimes destroyed in one night by a sudden frost that nips the blade and extinguishes the vegetation. The kingdom is moreover visited by some unfavourable years, in which the sun seems to have lost his genial power; the vegetables are stunted; the trees bud and bloom, yet bear no fruit; and the grain, though it rises, will yet produce nothing but empty ears and straw. This calamity, however, rarely occurs; and in general the cultivated parts of Norway yield plentiful crops of excellent rye, barley, and oats. The most fruitful provinces are Nordland, Inderbarre, and Numedale, in the diocese of Drontheim; Sognifiord and Vaas, in that of Bergen; Jedderen, Ryefylsk, Raabygdelag, and the lordship of Nedenes, in the diocese of Christiansand; Hedemark in the diocese of Aggerhus; Hadeland, Toten, Romerige, Ringerige, and Guldbrandsdale: these territories not only produce grain enough for their own consumption, but likewise support their neighbours, and even supply part of Sweden.—Pease are likewise propagated in this country, together with wheat, buckwheat, hops, hemp, and flax, but not to any considerable advantage. The meadows are well stored with pasturage for sheep and cattle, and the fields are productive of those vegetables which are common in other northern countries. Within these 50 years the people of Norway have bestowed some attention on the culture of gardens, which in former times was so neglected, that the cities and towns were supplied with leeks, cabbage, and roots, from England and Holland. At present, however, the Norwegians raise their own culinary and garden roots and vegetables, which thrive there as well as in any other country. The scurvy being a disease that prevails along the sea coast, Nature has scattered upon it a variety of herbs efficacious in the cure of that distemper; such as angelica, rose-wort, gentian, cresses, trefoil, sorrel, scurvy-grass, and a plant called *erich's grass*, that grows in great plenty on the islands of Nordland: from whence the people of the continent fetch away boat loads of it, to be preserved in barrels as a succedaneum for cabbage. There are also a few noxious vegetables little known in any country but Norway. In

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In Guldbrandsdale is a species of grass called *selfnape*; the root of which is so poisonous, that any beast which eats of it dies immediately, the belly bursting; nay, the carnivorous fowls that prey upon the carcass of the beast meet with the same fate: children have been more than once poisoned by this root, which nevertheless is sometimes used externally as an amulet for arthritic disorders. Another vegetable pernicious to the cattle is the *Gramen ossifragum Norwegiense*, which is said to mollify the bones of the cattle which feed upon it. Among the noxious plants of Norway we may also reckon the igle-grass, fatal to the sheep and goats; the tourgrass, which affects horses and cows with a sort of lethargy; and the plant torboe, or histe-spring, which produces nearly the same effect on horses, but is not at all prejudicial to cows, sheep, or any ruminating animals. The herb turte, not unlike angelica, operates nearly in the same manner: yet the bears are said to feed upon it with peculiar relish; and when their hair begins to fall off by feeding upon this plant, they cure themselves by eating the flesh of animals.

The common fruit trees thrive tolerably well in Norway, the inhabitants of which have plenty of cherries, apples, and pears. Some kinds of plums attain maturity; which is seldom the case with grapes, apricots, and peaches. But even the apples and pears that ripen here are summer fruit; that which grows till the winter seldom coming to perfection. Great variety of agreeable berries is produced in different parts of this kingdom; such as the hagebar, a kind of sloes; an infusion of which in wine makes a pleasant cooling liquor; juniper berries, corinths red and white, soelbar or sunberries, raspberries, gooseberries, blackberries, strawberries, &c. with many other species that seem to be natives of Norway and Sweden. Among those are the tranæbar, the produce of the myrtillus repens, red and austere, found in the spring in perfection under the snow, and much relished by the reindeer; crakebeer, resembling bilberries, deemed a powerful antiscorbutic; agerbeer, larger and blacker than bilberries, of a pleasant acid, ripened by cold, and used as cherries for an infusion in wine; and finally tyltebeer, a red pleasant berry growing on a short stem, with leaves like those of box; they are plucked off by handfuls, and sent to Denmark to be preserved for the table, where they are eaten by way of dessert.

Of the trees that grow wild in Norway, the principal are the fir and the pine. The first yield an annual revenue of 1,000,000 of rixdollars, if we include the advantages resulting from the saw mills and the masts; one of which last has been known to sell for 200 rixdollars. The red fir tree, which grows on the mountains, is so rich in turpentine as to be almost incorruptible. Some of the houses belonging to the Norway peasants, built of this timber, are supposed to be above 400 years standing. In Guldbrandsdale the house is still to be seen standing in which King Olaf lodged five nights, above 700 years ago, when he travelled round the kingdom to convert the people to the Christian faith. Even 100 years after the trunk of the fir tree has been cut down, the peasants burn the roots for tar, which is a very profitable commodity. In the fens, the resin of the fir tree is by nature transformed into a substance which may be called *Norway frankincense*. The buds or pine apples of this tree, boiled in stale beer, make an excellent medicine for the scurvy; less unpleasant to the taste, though as efficacious, as tar-water. The pine tree is more tall and beautiful than the fir, though inferior to it in strength and quality; for which reason the planks of it are sold at an inferior price, and the peasants waste it without remorse. Norway likewise produces some forests of oak, which is found to be excellent for ship-building. Here also grow plenty of elm trees; the bark of which, being powdered, is boiled up with other food to fatten hogs, and even mixed by the poor among their meal; also the ash, from which the peasants distil a balsam used in certain disorders, and which is used both externally and internally. Many other trees flourish in this country, an enumeration of which would prove too tedious. Hazels grow here in such abundance, that 100 tons of the nuts are annually exported from Bergen alone.

A great diversity of stones is found in Norway, some of which are of a surprising figure. Several mountains consist chiefly of a brown pebble, which decays with age; nay, it sometimes dissolves, and drops into the sea, and the cement being thus loosened, a terrible disruption ensues. In some places the gray and black pebbles are intermixed with iron, copper, lead, silver, and gold. The ground in certain districts is covered with the fragments of rocks that have been precipitated from the summits of mountains, and broken by their fall into innumerable shivers. Between 20 and 30 years ago, in the neighbourhood of Bergen, a man was suddenly overwhelmed with such a mass, which formed a kind of vault around him. In this dreadful tomb he remained alive for several weeks. By his loud cries the place of his confinement was discovered: but it was found impossible to remove the huge stones by which he was inclosed. All that his friends could do for him was, to lower down meat and drink through some crevices; but at length the stones fell in, and crushed him to death.

In Norway are inexhaustible quarries of excellent marble, black, white, blue, gray, and variegated; together with some detached pieces of alabaster, several kinds of spar, chalk-stone, gypsum, sand-stone, millstone, baking-stone, slate, talc, magnets, and swine-stone, a production natural to Norway and Sweden, of a brown colour, fetid smell, in texture resembling crystal, and deriving its name from a supposed efficacy in curing a distemper incident to swine. Here also is found the amianthus or stone-flax, of which incombustible cloth may be made. Norway, however, affords no flints, but plenty of pyrites, beautiful rock crystals, granites, amethysts, agate, thunder-stones, and eagle-stones. Gold has formerly been found in small quantity in the diocese of Christiansand, and coined into ducats. There is at present a very considerable silver mine wrought at Kongsberg on account and at the risk of his Danish majesty: the ore is surprisingly rich, but interrupted in such a manner, that the vein is often lost. Many masses of pure silver have been found; and, among the rest, one piece weighing 560 pounds, preserved in the royal museum at Copenhagen. Such is the richness of these mines, that the annual produce amounts in value to a ton and a half in gold. About 5000 people are daily employed, and earn their subsistence, in those stupendous works.

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works (A). Other silver mines are prosecuted at Jarlsberg, but not to the same advantage; and here the ore is mixed with lead and copper. In many parts of this country copper mines have been discovered; but the principal, and perhaps the richest in all Europe, is at Roraas, about 100 English miles from Drontheim. This work yields annually about 1100 ship pounds of pure copper: the founderies belonging to it consume yearly about 14,000 lasts of coal, and 500 fathoms of wood. The next in importance is the copper work at Lykken, about 20 miles from Drontheim. A third mine is carried on at Indset or Quickne, at the distance of 30 miles from the same place; and here they precipitate the copper from its menstruum, by means of iron. There is a fourth copper work at Silboe, about 30 miles distant from Drontheim, though the least considerable of the four. Other copper mines of less note are worked in different parts of the kingdom. Iron is still in greater plenty, and was the first metal wrought in this country. Many hundred thousand quintals are annually exported, chiefly in bars, and part of it in stoves, pots, kettles, and cannon: the national profit arising from this metal is estimated at 300,000 rixdollars. There is a species called *moor-iron*, found in large lumps among the morasses: of this the peasants make their own domestic tools and utensils, such as knives, scythes, and axes. The lead found mixed in the silver ore is an article of small importance in Norway; yet some mines of this metal have been lately opened in the district of Soloer by the proprietors of the copper work at Oudal. A vitriol work has been begun near Kongsberg: the mines yield great plenty of sulphur; which, however, the Norwegians will not take the trouble to melt and depurate, because immense quantities are found at a cheaper rate in the island of Iceland. Alum is found between the slate flakes near Christiana in such plenty, that works have been set up for refining this mineral, though they have not yet brought it to any degree of transparency. His Danish majesty has established salt works in the peninsula of Valoe, about six English miles from Tonsberg, where this mineral is extracted in large quantities from the sea water.

Besides the animals common to other countries, Norway is said to contain many of the uncommon and dubious kind; such as the kraken, mermaid, sea serpent, &c. See these articles.

Many Danish, English, Scotch, Dutch, and German families have now settled in Norway; and indeed form no inconsiderable part of the trading people: but the original inhabitants are the descendants of those ferocious Normanni, who harassed almost all the coasts of Europe with piratical armaments in the 8th, 9th, and 10th centuries.

"Our first certain knowledge of the inhabitants of this country (says Pennant *) was from the desolation they brought on the southern nations by their piratical invasions. Their country had before that period the name of *Nortmanland*, and the inhabitants *Nortmans*, a title which included other adjacent people. Great Britain and Ireland were ravaged by them in 845; and they continued their invasion till they effected the conquest of England, under their leader Canute the Great. They went up the Seine as far as Paris, burnt the town, and forced its weak monarch to purchase their absence at the price of fourteen thousand marks. They plundered Spain, and at length carried their excursions through the Mediterranean to Italy, and even into Sicily. They used narrow vessels, like their ancestors the Sitones; and, besides oars, added the improvement of two sails; and victualled them with salted provisions, biscuit, cheese, and beer. Their ships were at first small; but in after times they were large enough to hold 100 or 120 men. But the multitude of vessels was amazing. The fleet of Harold Blaatand consisted of 700. A hundred thousand of these savages have at once sailed from Scandinavia, so justly styled *Officina gentium, aut certè velut vagina nationum*. Probably necessity, more than ambition, caused them to discharge their country of its exuberant numbers. Multitudes were destroyed; but multitudes remained, and peopled more favourable climates.

"Their king, Olaus, was a convert to Christianity in 994; Bernard an Englishman had the honour of baptizing him, when Olaus happened to touch at one of the Scilly islands. He plundered with great spirit during several years; and in 1006 received the crown of martyrdom from his pagan subjects. But religious zeal first gave the rest of Europe a knowledge of their country and the sweets of its commerce. The Hanse towns poured in their missionaries, and reaped a temporal harvest. By the year 1204, the merchants obtained from the wise prince Suer every encouragement to commerce; and by that means introduced wealth and civilization into his barren kingdom. England by every method cherished the advantages resulting from an intercourse with Norway, and Bergen was the emporium. Henry III. in 1217, entered into a league with its monarch Haquin; by which both princes stipulated for free access for their subjects into their respective kingdoms, free trade, and security to their persons. In 1269, Henry entered into another treaty with Magnus; in which it was agreed, that no goods should be exported from either kingdom except they had been paid for; and there is, besides, a humane provision on both sides, for the security of the persons and effects of the subjects, who should suffer shipwreck on their several coasts."

The inhabitants now speak the same language that is used in Denmark, though their original tongue is the dialect now spoken in Iceland. They profess the Lutheran religion, under an archbishop established at Drontheim,

* Arct. Zool.

(A) Mr Coxe tells us, that he visited those mines. They formerly, he says, produced annually 70,000l. but at present yield little more than 50,000l. The expences generally exceed the profits; and government gains only by the number of miners employed. The mines of cobalt, and the preparation of Prussian blue, are much more productive. The latter goes through 270 hands, and the number of men employed is 365. It is supposed, that, at this period (1793), it may produce to government a profit of 16,000l. a-year.

Norway. Drontheim, with four suffragans; namely, of Bergen, Staffanger, Hammer, and Christiana. By the union of Calmar, the two kingdoms of Norway and Denmark were united under one monarch; and then the people of both nations enjoyed considerable privileges: but the Danish government soon became absolute; and Norway was ruled despotically by a viceroy, who resided in the capital, and presided in the supreme court, to which appeals were made from the subordinate courts of judicature. The rigour of the government was however greatly mitigated, during the reign of the present king of Denmark.

The Norwegians are generally well formed, tall, sturdy, and robust, brave, hardy, honest, hospitable, and ingenious; yet savage, rash, quarrelsome, and litigious. The same character will nearly suit the inhabitants of every mountainous country in the northern climates. Their women are well shaped, tall, comely, remarkably fair, and obliging. The nobility of Norway have been chiefly removed by the kings of Denmark, in order to prevent faction and opposition to the court; or are long ago degenerated into the rank of peasants; some families, however, have been lately raised to that dignity. Every freeholder in Norway enjoys the right of primogeniture and power of redemption; and it is very usual to see a peasant inhabiting the same house which has been possessed 400 years by his ancestors. The *odels-gads*, or freehold, cannot be alienated by sale or otherwise from the right heir, called *odels-mand*: if he is not able to redeem the estate, he declares his incapacity every 10th year at the sessions; and if he, or his heirs to the third generation, should acquire wealth enough for that purpose, the possessor *pro tempore* must resign his possession.

The mountaineers acquire surprising strength and dexterity by hard living, cold, laborious exercise, climbing rocks, skating on the snow, and handling arms, which they carry from their youth to defend themselves against the wild beasts of the forest. Those who dwell in the maritime parts of Norway exercise the employments of fishing and navigation, and become very expert mariners.

The peasants of Norway never employ any handicraftsmen for necessaries to themselves and families: they are their own hatters, shoemakers, taylors, tanners, weavers, carpenters, smiths, and joiners: they are even expert at ship-building; and some of them make excellent violins. But their general turn is for carving in wood, which they execute in a surprising manner with a common knife of their own forging. They are taught in their youth to wrestle, ride, swim, skate, climb, shoot, and forge iron. Their amusements consist in making verses, blowing the horn, or playing upon a kind of guitar, and the violin: this last kind of music they perform even at funerals. The Norwegians have evinced their valour and fidelity in a thousand different instances. The country was always distracted by intestine quarrels, which raged from generation to generation. Even the farmers stand upon their punctilio, and challenge one another to single combat with their knives. On such occasions they hook themselves together by their belts, and fight until one of them is killed or mortally wounded. At weddings and public feasts they drink to intoxication, quarrel, fight, and murder generally ensues. The very common people are likewise passionate, ambitious of glory and independence, and vain of their pedigree. The nobility and merchants of Norway fare sumptuously; but the peasant lives with the utmost temperance and frugality, except at festivals: his common bread is made of oatmeal, rolled into broad thin cakes, like those used in Scotland. In time of scarcity, they boil, dry, and grind the bark of the fir tree into a kind of flour which they mix with oat meal: the bark of the elm tree is used in the same manner. In those parts where a fishery is carried on, they knead the roes of cod with their oat meal. Of these last, mixed with barley meal, they make hasty pudding and soup, enriched with a pickled herring or salted mackerel. Fresh fish they have in plenty on the sea coast. They hunt and eat grouse, partridge, hare, red deer, and reindeer. They kill cows, sheep, and goats, for their winter stock: these they pickle, or smoke, or dry for use. They make cheese of their milk, and a liquor called *syre* of their sour whey: this they commonly drink mixed with water; but they provide a store of strong ale for Christmas, weddings, christenings, and other entertainments. From their temperance and exercise, joined to the purity and elasticity of their air, they enjoy good health, and often attain to a surprising degree of longevity. Nothing is more common than to see a hearty Norwegian turned of 100. In the year 1733, four couples danced before his Danish majesty at Frederickshall: their ages, when joined, exceeded 800 years. Nevertheless the Norwegians are subject to various diseases; such as the scab, the leprosy, the scurvy, the catarrh, the rheumatism, gout, and epilepsy. The dress of the Norway peasants consists of a wide loose jacket made of coarse cloth, with waistcoat and breeches of the same. Their heads are covered with flapped hats, or caps ornamented with ribbons. They wear shoes without outer soles, and in the winter leathern buskins. They have likewise snow shoes and long skates, with which they travel at a great pace, either on the land or ice. There is a corps of soldiers thus accoutred, who can outmarch the swiftest horses. The Norwegian peasant never wears a neckcloth, except on extraordinary occasions: he opens his neck and breast to the weather, and lets the snow beat into his bosom. His body is girt round with a broad leathern belt, adorned with brass plates, from which depends a brass chain that sustains a large knife, gimlet, and other tackle. The women are dressed in close laced jackets, having leathern girdles decorated with ornaments of silver. They likewise wear silver chains round their necks, to the ends of which are fixed gilt medals. Their caps and handkerchiefs are almost covered with small plates of silver, brass, and tin, large rings, and buttons. A maiden bride appears with her hair plaited, and, together with her clothes, hung full of such jingling trinkets.

The churches, public edifices, and many private houses in Norway, are built of stone; but the people in general live in wooden houses, made of the trunks of fir and pine tree laid upon each other, and joined by mortises at the corners. These are counted more dry, warm, and healthy, than stone or brick buildings. In the whole diocese of Bergen, one hardly sees a farm house with a chimney or window: they are generally lighted by a square hole in the top of the house, which lets in the light, and lets out the smoke. In summer this hole is left quite open: in the winter, it is covered with what they call a *siau*; that is, the membrane of some animal, stretched upon a wooden frame that fits the hole, and transmits the rays of light. It is fixed or removed with a long pole occasionally. Every person that

that enters the house, upon business or courtship, takes hold of this pole, according to ancient custom. The ceiling is about eight feet high in the middle; and, being arched like a cupola, the smoke of the fire underneath rolls about, until it finds a vent at the hole, which is called *liur*. Under this opening stands a thick table with benches, and a high seat at the upper end for the master of the family: he has likewise a small cupboard for his own use, in which he locks up his most valuable effects. The boards of the roof are coated with the bark of the birch trees, which is counted incorruptible: this again is covered with turf, which yields a good crop of grass for goats and sheep, and is often mowed as hay by the farmer.

The Norwegians carry on a considerable trade with foreign nations. The duty on the produce of their own country exported, amounts annually to 100,000 rixdollars. These commodities are, copper wrought and unwrought; iron cast into cannon, stoves, and pots, or forged into bars; lead, in small quantity; masts, timber, deal boards, planks, marble, millstones, herring, cod, ling, salmon, lobsters, flounders, cow hides, goat skins, seal skins, the furs of bears, wolves, foxes, beavers, ermines, martens, &c. down, feathers, butter, tallow, train oil, tar, juniper, and other sorts of berries, and nuts; salt, alum, glass, vitriol, and pot ashes. All other commodities and articles of luxury the Norwegians import from different nations. The nature of the ground does not admit of much improvement in agriculture: nevertheless, the farmers are not deficient in industry and skill to drain marshes, and render the ground arable and fit for pasture. Many are employed in grazing and breeding cattle: but a much greater number is engaged in felling wood, floating timber, burning charcoal, and extracting tar from the roots of the trees which have been cut down; in the silver, copper, and iron mines; in the navigation and fishery. A considerable number of people earn a comfortable livelihood by hunting, shooting, and bird-catching. Every individual is at liberty to pursue the game, especially in the mountains and commons: therefore every peasant is expert in the use of fire arms; and there are excellent marksmen among the mountains, who make use of the bow to kill those animals, whose skins, being valuable, would be damaged by the shot of fire arms.

Norway can produce above 14,000 excellent seamen. The army of this country amounts to 30,000 effective men; and the annual revenue exceeds 800,000 rixdollars.

In consequence of an agreement between Russia, Sweden, and Great Britain in 1812, the king of Denmark was compelled to cede this country to Sweden, and a treaty to that effect was made at Kiel in January 1814. The Norwegians, indignant at having their liberties bartered away, invited Prince Christian, a younger son of the Danish monarch, to accept of the regency, and declared themselves independent. A representative constitution was framed, and the people took up arms to resist the Swedes. But their resistance was vain; the crown prince (Bernadotte) entered the country with a strong army, and the British fleet at the same time blockading the coast, the Norwegians were forced to submit in August 1814. Norway was united to the Swedish crown, but retained its separate legislature as organized a short time before.

Norway Rat. See Mus, Mammalia *Index*.

NORWICH, the capital of the county of Norfolk in England, situated in E. Long. 1. 26. N. Lat. 52. 40. It is supposed to have had its name, which signifies "a castle to the north," from its situation in respect of Caster, the ancient Venta Icenorum, three or four miles to the south of it, out of whose ruins it seems to have risen. In its infancy, in the reign of Etheldred, it was plundered and burnt by Sueno the Dane, when he invaded England with a great army. Afterwards it recovered; and in the reign of Edward the Confessor was a considerable place, having 1320 burghers. But it suffered again much in the reign of William I. by being the seat of a civil war, which Ralph earl of the East Angles raised against that king. So much was it impaired by the siege it then underwent, that there were scarce 560 burghers left in it, as appears from Doomsday book. From that time forward it began by little and little to recover, especially after Bishop Herbert translated the episcopal see hither from Thetford in the reign of William Rufus in 1096; and built a beautiful cathedral. In the time of Edward I. it was walled round by the citizens, who had presented a petition to parliament for liberty to do it. Henry IV. allowed them, instead of bailiffs, which they had before, to elect a mayor yearly, and made the city a county of itself. In the year 1348, near 58,000 persons were carried off by the plague; and in 1505 the city was almost consumed by fire. For the flourishing state to which the city is now arrived, they are much indebted to the Flemings, who fled hither from the tyranny of the duke of Alva and the inquisition, and taught them the manufacture of those striped and flowered damasks, camblets, druggets, black and white crape, for which the place is now so noted, and which have been computed to yield sometimes 200,000l. a-year. In the year 1583, the citizens, by the help of an engine, conveyed water through pipes to the highest parts of the city, which is pleasantly seated along the side of a hill, extending a mile and a half in length from north to south; but the breadth is much less, and it contracts itself by degrees towards the south. It is now one of the most considerable cities in Britain for wealth, populousness, neat buildings, beautiful churches, (of which it had once 58, but now only 36), and the industry and civility of the inhabitants. The cathedral is a very venerable structure, with a curious roof, adorned with the history of the Bible in little images, carved to the life, and a lofty steeple 105 yards high. The wall of flint stone, beautified with 40 towers and 12 gates, finished in 1309, is now much decayed. The city, though there is a great deal of waste ground within the walls, was computed, about 60 years ago, to contain 8000 houses and 50,000 inhabitants. In 1811 the inhabitants amounted to 37,256. Besides the cathedral already mentioned, the most remarkable buildings are, the duke of Norfolk's house, one of the largest in England; the castle, which is now the county gaol, and stands in the heart of the city, with a deep moat round it, over which is a bridge of one very large arch; the town hall; the guild hall, formerly the church belonging to the monastery of Black Friars; the house of correction; the shire house, where the assizes are held; a lofty market cross, built after the manner of a piazza; the bishop's palace; the king's school, founded by Edward VI. the boys of which are nominated by the mayor for the time being, with the consent

Norwich. consent of the majority of aldermen. There having been formerly many thatched houses, an order was made, that all houses that should hereafter be built should be covered with tiles. The city is interspersed with gardens, orchards, and trees, which make it both pleasant and healthful. It has four hospitals, in which a great number of old men and women, boys and girls, are maintained; and a dozen charity schools. Here are two churches for the Dutch and French Flemings; who have particular privileges, and are very numerous. Some of the churches are thatched, and all of them crusted with flint stone curiously cut; which is the more wonderful, as Norwich stands in a clay country, and has no flint within 20 miles of it. It is now governed by a mayor, recorder, steward, two sheriffs, 24 aldermen, 60 common council, with a town clerk, sword-bearer, and other inferior officers. The mayor is chosen on May-day by the freemen, and sworn in on the Tuesday before Midsummer-eve. The sheriffs are also chosen annually, on the first Tuesday in August, one by the freemen, the other by the aldermen, and sworn in on Michaelmas day. The freemen of the several wards choose each their alderman. The common council is chosen in Midlent. The mayor is a justice of the peace and quorum, during his year (as are also the recorder and steward) within the city and liberties; and after his mayoralty, he is a justice during life. The trade and manufactures of the city are very considerable. At Yarmouth they export large quantities of their manufactures, most of which are sent to London; and import a great deal of wine, coal, fish, oil, &c. All the city and country round are employed in the worsted manufacture, brought hither, as already observed, by the Flemings, in which they not only consume the wool of their own county, in spinning, weaving, &c. but use many thousand packs of yarn which they receive from other parts of England, as far as Yorkshire and Westmoreland. There are eight wardens of the weavers chosen annually, and sworn to take care that there be no frauds committed in spinning, weaving or dyeing the stuffs. It is computed that there are not less than 120,000 people employed in the city and neighbourhood in the silk and woollen manufactures. Their markets are thought to be the greatest in England, and furnished with a surprising plenty and variety of goods and provisions. At a small village to the north of the city, called *St Faith's*, not less than 40,000 head of Scotch cattle are said to be yearly bought up by the Norfolk graziers, and fattened in their meadows and marshes. Its markets are on Wednesday, Friday, and Saturday. It has a great number of fairs, sends two members to parliament, and gives the title of earl to the duke of Gordon.

Few cities or towns seem to have suffered more than Norwich has done at various periods, and few seem to have felt it less; for though quite burnt down by Sueno as above, it was of considerable consequence in Edward the Confessor's time; nor did it long feel the evils of the insurrection and siege in William the Conqueror's time, for it was rebuilt in Stephen's reign, and made a corporation.

The city of Norwich has long been famous for its manufactures; which are not, in the opinion of some, at present in so flourishing a state as formerly. In addition to the manufacture of camblets, druggets, and crapes, it is also remarkable for baize, serges, shalloons, stockings, and woollen cloths. Norwich, Nose.

The inhabitants of Norwich are generally so employed in their manufactures within doors, that the city has the appearance of being deserted, except on Sundays and holidays, when the streets swarm with people.

Caster, near Norwich, was the Venta Icenorum, or capital city of the Iceni, the broken walls of which contain a square of about thirty acres. In those walls may still be perceived the remains of four gates and a tower. Several Roman urns, coins, and other relicks of antiquity, have been found in this place.

NOSE, the organ of smell. See ANATOMY. The uses of the nose are, its giving us the sense of smelling; its serving in the great office of respiration, and in modelling the voice; in receiving the abundant humours from the eyes, and in adding to the beauty of the face.

The nose was by the augurs particularly attended to in forming conjectures concerning future good or ill success. The tingling of the right or left side of it, for instance, was thought to have different significations as it happened to different sexes, or persons in different conditions.

In Tartary, the greatest beauties are those who have the least noses. Ruybrock mentions the wife of the great Jenghiz Khan as a celebrated beauty, because she had only two holes for a nose. The Crim Tartars break the noses of their children while young, as thinking it a great piece of folly to have their noses stand before their eyes. In most other countries, China excepted, great noses are an honour.

In what the beauty of the nose consists, different nations have different opinions: and the following reflections of Sir Joshua Reynolds on this subject are perhaps the most philosophical account of the beauty of form that is to be found in any language. "I *Idler*, vol. ii. suppose (says Sir Joshua) it will be easily granted, that no man can judge whether any animal be beautiful in its kind, or deformed, who has seen only one of that species: that is as conclusive in regard to the human figure; so that if a man born blind was to recover his sight, and the most beautiful woman was brought before him, he could not determine whether she was handsome or not; nor, if the most beautiful and most deformed were produced, could he any better determine to which he should give the preference, having seen only those two. To distinguish beauty, then, implies the having seen many individuals of that species. If it is asked, how is more skill required by the observation of greater numbers? I answer, that, in consequence of having seen many, the power is acquired, even without seeking after it, of distinguishing between accidental blemishes and excrescences, which are continually varying the surface of Nature's works, and the invariable general form which Nature most frequently produces, and always seems to intend in her productions.

"Thus amongst the blades of grass or leaves of the same tree, though no two can be found exactly alike, yet the general form is invariable: a naturalist, before he chose one as a sample, would examine many, since, if he took the first that occurred, it might have, by accident or otherwise, such a form as that it would scarce be known to belong to that species; he selects as the painter does, the most beautiful, that is, the most general form of nature.

"Every species of the animal as well as the vegetable creation may be said to have a fixed or determinate form, towards which nature is continually inclining, like various lines terminating in the centre; or it may be compared to pendulums vibrating in different directions over one central point; and as they all cross the centre, though only one passes through any other point, so it will be found that perfect beauty is oftener produced by nature than deformity: I do not mean than deformity in general, but than any one kind of deformity. To instance in a particular part of a feature: the line that forms the ridge of the nose is beautiful when it is straight; this then is the central form, which is oftener found than either concave, convex, or any other irregular form that shall be proposed. As we are then more accustomed to beauty than deformity, we may conclude that to be the reason why we approve and admire it, as we approve and admire customs and fashions of dress for no other reason than that we are used to them; so that though habit and custom cannot be said to be the cause of beauty, it is certainly the cause of our liking it: and I have no doubt, but that if we were more used to deformity than beauty, deformity would then lose the idea now annexed to it, and take that of beauty; as if the whole world should agree that *yes* and *no* should change their meanings, *yes* would then deny, and *no* would affirm.

"Whoever undertakes to proceed further in this argument, and endeavours to fix a general criterion of beauty respecting different species, or to show why one species is more beautiful than another, it will be required from him first to prove that one species is really more beautiful than another. That we prefer one to the other, and with very good reason, will be readily granted; but it does not follow from thence that we think it a more beautiful form; for we have no criterion of form by which to determine our judgment. He who says a swan is more beautiful than a dove, means little more than that he has more pleasure in seeing a swan than a dove, either from the stateliness of its motions, or its being a more rare bird; and he who gives the preference to the dove, does it from some association of ideas of innocence that he always annexes to the dove; but if he pretends to defend the preference he gives to one or the other, by endeavouring to prove that this more beautiful form proceeds from a particular gradation of magnitude, undulation of a curve, or direction of a line, or whatever other conceit of his imagination he shall fix on as a criterion of form, he will be continually contradicting himself, and find at last that the great mother Nature will not be subjected to such narrow rules. Among the various reasons why we prefer one part of her works to another, the most general, I believe, is habit and custom: custom makes, in a certain sense, white black, and black white; it is custom alone determines our preference of the colour of the Europeans to the Æthiopians; and they, for the same reason, prefer their own colour to ours. I suppose nobody will doubt, if one of their painters was to paint the goddess of beauty, but that he would represent her black, with thick lips, flat nose, and woolly hair; and it seems to me he would act very unnaturally if he did not; for by what criterion will any one dispute the propriety of his idea? We indeed say, that the form and colour of the European is preferable to that of the Ethiopian: but I know of no other reason we have for it, but that we are more accustomed to it. It is absurd to say, that beauty is possessed of attractive powers, which irresistibly seize the corresponding mind with love and admiration, since that argument is equally conclusive in favour of the white and the black philosopher.

"The black and white nations must, in respect of beauty, be considered as of different kinds, at least a different species of the same kind; from one of which to the other, as I observed, no inference can be drawn.

"Novelty is said to be one of the causes of beauty: that novelty is a very sufficient reason why we should admire, is not denied; but because it is uncommon, is it therefore beautiful? The beauty that is produced by colour, as when we prefer one bird to another, though of the same form, on account of its colour, has nothing to do with this argument, which reaches only to form, I have here considered the word beauty as being properly applied to form alone. There is a necessity of fixing this confined sense; for there can be no argument, if the sense of the word is extended to every thing that is approved. A rose may as well be said to be beautiful, because it has a fine smell, as a bird because of its colour. When we apply the word *beauty*, we do not mean always by it a more beautiful form, but something valuable on account of its rarity, usefulness, colour, or any other property. A horse is said to be a beautiful animal; but had a horse as few good qualities as a tortoise, I do not imagine that he would be then esteemed beautiful.

"A fitness to the end proposed is said to be another cause of beauty; but supposing we were proper judges of what form is the most proper in an animal to constitute strength or swiftness, we always determine concerning its beauty before we exert our understanding to judge of its fitness.

"From what has been said, it may be inferred, that the works of nature, if we compare one species with another, are all equally beautiful; and that preference is given from custom, or some association of ideas; and that in creatures of the same species, beauty is the medium or centre of all various forms. See the article Beauty, towards the end.

NOSOLOGY, is a Greek word signifying a discourse or treatise of diseases; otherwise called *pathology*.

The importance of a comprehensive and accurate nosology has been long and generally allowed. Baglivi, Boerhaave, Gorter, Gaubius, and Sydenham, have expressed their desire of a work of this kind, the great object of which is to fix pathognomonics to every disease; or in which all diseases are disposed into certain classes, orders, and genera, founded on distinctions taken from the symptoms only, without regard to remote or proximate causes. See Medicine.

NOSTOCH, Shot Stars; *tremella nostoc*, (Lin. Spec. Plant. Dillenius de Muscis, tab. 10. fig. 14. Flor. Danica, tab. 885. fig. 1); *tremella intestinalis vel mesenterica*, Nostoch. *mesenterica*, (Lin. Spec. Plant. Dillen. de Mus. tab. 10. fig. 16. Flor. Danic. tab. 885. fig. 2.).

A writer in the Gentleman's Magazine gives this account of it: "The substance in question is not unfrequent in England, nor in all other parts of Europe, after rains, both in spring and autumn. Very large spots of it are seen in gravelly soils, and particularly on the tops of hills, and on open downs, and often it is found on gravel walks.

"It is met with in some of the old authors, under the name of *nostoch*, as in Paracelsus and others; and the alchemists fancied there was something wonderful in it, and that it would afford a menstruum for gold. Nostoch is said to be a word synonymous to *Jaculum alicujus stellæ, vel potius ejus repurgatione dejectum quid in terram*; *flos aëris*; *fragmentum nimbi*; as this substance was believed to fall from the sky with the meteors that we often see, and call *falling-stars*. Hence the country people in Sweden have called it *sky-fall*; and in England it is known by the name of *witches butter*, in common with some of the gelatinous liverworts.

"Paracelsus, Helmont, and others, ranked it with the *terniabin*, or manna, and thought it dropped, as that did, from heaven. It is described, and the chemical analysis thereof given, by M. Geoffroy, in the Paris Memoirs for 1708, and is there said to yield, besides an acid phlegm, a portion of concrete volatile salt and some fixed salt. The distilled water from it was believed by some to possess singular virtues, in allaying pains of the joints; but there is certainly no room to attribute any extraordinary qualities to it.

"Since the days of Paracelsus it has been considered as a vegetable production; but the botanists have had difficulty to assign its place or genus in their several systems. Our own countryman, Dr Merret, seems to have been among the first authors who ranked it among vegetables, and he calls it *Lichen humiditate intumescens, siccitate evanescens* (Pin. page 71.). Others have retained it among the plants of that genus to this day; as does the celebrated Dr Haller, in his *Historia Stirp. Helvetiæ*, who calls it *Lichen gelatinosus, plicatus, undulatus; laciniis crispatis, granulosis*, N° 2041, as there are several of the liverworts that have a gelatinous texture and appearance; though they differ much from the nostoch, in not being so instantly dried up. It was put into Ray's Synopsis, by Dr Dillenius, under the name of *Ulva terrestris pinguis et fugax*, p. 64.; but he afterwards changed that name for *tremella*, in his *Historia Muscorum*, whence he calls it *tremella terrestris sinuosa pinguis et fugax*, p. 52. tab. 10. f. 14, and reduces the lavers to the same genus. Micheli, an Italian botanist, famous for his attention to the Cryptogamia class of plants, makes it a *fungus*, as Magnol and Dr Morison had done before him, and describes and figures it, in his *Nova Plantarum Genera*, under the name of *Linkia terrestris gelatinosa, membranacea, vulgatissima*, p. 126. t. 67. f. 1. He describes the seeds as lying in the form of little strings of beads, coiled up within the plant, or rather in the folds thereof, and only to be discovered by the microscope. Linnæus mentions it, first under the name of *Byssus gelatinosa fugax terrestris*, in his *Flora Lapponica*, N° 530; but he afterwards adopted Dillenius's term, though he does not make it a laver. Linnæus has called it, in all his subsequent works, *tremella (nostoc) plicata, undulata*, under which name it stands in his *Species Plantarum*, p. 1157, and in Hudson's *Flora Anglica*, p. 463, as also in a numerous set of other authors who follow his system." Nostoch.

Another writer in the same work gives this account of it. "This substance is very rarely seen between the middle of April and the month of October. It is most frequently to be found in the high pasture lands, where the ground is inclined to wet, and on the moors and commons in the north of England. The time we always meet with it is after a very wet night, when the air in the morning suddenly clears up, and a sharp frost ensues. The frogs that then happen to be out are immediately seized by the frost, and turned into this jelly-like substance. For as I have had occasion sometimes to go out very early, I have found several parts of the frog not yet dissolved among the jelly, such as feet, legs, and thighs, yet in a little time afterwards the change was fully completed. The quantity of jelly produced from one single frog is almost beyond belief, even to five or six times its bulk when in its natural state.

"I communicated this discovery to an acquaintance, who has since had frequent opportunities of observing and examining this production; and we are fully assured, that, whatever opinion the learned may have of it, it certainly proceeds from the above-mentioned cause wherever found.

"Most people that I have conversed with on the subject, are of opinion that this jelly falls from the stars, or out of the higher regions of the air; which notion, however absurd, many are credulous enough to believe."

Naturalists had for some years begun to doubt whether these gelatinous substances were of a vegetable or animal nature, when at length Mr J. Platt of Oxford, in a letter printed in the Gentleman's Magazine for 1776, page 402, threw such light on the subject as to us, at least, is perfectly satisfactory.

"From a child I remember seeing the meteors shooting in the air, which appearance, by my comrades, was called *star-shooting*, believing the stars no larger than their apparent magnitude. This jelly-like substance mentioned in your magazine, was believed to be the dross of these meteors, and took the name of *star-shot*, which passed for certain with me till I had arrived at the age of 24, when I was engaged in business that required my frequently passing over both meadows and pasture-grounds, where in spring and autumn I saw many portions of this supposed alga or nostoch, but never more than one or two contiguous, mostly near the water, when the meadows were or had been just before flooded. My conjectures were various, until I saw a crow pecking of something in a field, which I heard to cry; when turning my horse to the place, I found a frog of the common size, which the crow (of the carrion kind) would soon have killed and gorged, had I not disturbed her, and chased her away.

"About this time I found in a meadow the bowels of a frog indigested, and compact as the chitterlings of a calf or pig; but white as the paper I write upon, though not translucid. I took it up and placed it in a paper exposed to the air; leaving it in some grass where I found it, till my return that way in three days time, Nostoch, Nostradamus.

time, when I saw it changed to that tremulous jelly-like substance, the alga or star-shot. I was much pleased with this discovery, and took it home in my pocket wrapped in a paper, where I showed it to a society of young persons of which I was a member, who agreed with my sentiments of its being the indigestible part of a frog disgorged by some bird of prey.

"To corroborate my sentiments of this alga being the bowels of a frog, I luckily saw some of it lying by the side of a brook, where I lighted and took it up, and to my great surprise found attached to the jelly the head, heart, liver, and one leg of the frog, which had been (I presume) disgorged by some carrion crow, who frequented the flooded grounds to pick up worms and other vermine. There was also some of it found on an apple tree at Wyston Magna, near Leicester, where I then lived, which, no doubt, was disgorged by some owl."

Dr Darwin, in his Poem on the Loves of the Plants, is of the same opinion with Mr Platt, that these gelatinous substances are of an animal nature, and that the different appearances they put on are owing to various circumstances, viz. the different birds who feed on frogs, the quantity they devour at a time, and the state of digestion before they are voided.

NOSTRADAMUS, Michel, an able physician and a celebrated astrologer, was a Provençal, and descended of a noble family, and born Dec. 14. 1503, at St Remy, in the diocese of Avignon. By his grandfather he was initiated in the study of the mathematics. He afterwards completed his courses of humanity and philosophy at Avignon; and, going thence to Montpelier, he there applied himself to physic, till being forced away by the plague in 1525, he took his route towards Thoulouse, and passed on till he came to Bourdeaux. This course held him five years, during which he undertook the cure of all such patients as were willing to put themselves under his care. After this he returned to Montpelier, and was created doctor of his faculty in 1529, and then revisited the same places where he had practised physic before. At Agen he contracted an acquaintance with Julius Cæsar Scaliger, which induced him to make some stay in that town, and there he entered into matrimony; but having buried his wife, and two children which she brought him, he quitted Agen after a residence of about four years. He returned into Provence, and fixed himself first at Marseilles; but his friends having provided an advantageous match for him at Salon, he transported himself thither in 1544. In 1546, Aix being afflicted with the plague, he went thither at the solicitation of the inhabitants, and was of great service; particularly by a powder of his own invention: so that the town in gratitude gave him a considerable pension for several years after the contagion ceased. Returning afterwards to Salon, he became a recluse, and made use of his leisure to apply himself to his studies. He had a long time followed the trade of a conjurer occasionally; and now he began to think himself inspired, and miraculously illuminated with a prospect into futurity. As fast as these illuminations had discovered to him any future event, he entered it in writing, in simple prose, but by enigmatical sentences, as he declared himself; but revising them afterwards, he thought the sentences would appear more respectable, and would savour more of a prophetic spirit, if they were expressed in verse. This opinion determined him to throw them all into quatrains, and he afterwards ranged them into centuries. When this was done, he hesitated about making them public, till reflecting that the time of many events which he had foretold was very near at hand, he determined to print them. This he did with a dedication addressed to his son Cæsar, an infant only some months old, in the form of a letter or preface, dated March 1. 1555. This first edition, which is included in seven centuries, was printed by Rigault at Lyons. He prefixed his name in Latin, but gave to his son Cæsar the name as it is pronounced, *Notradame*.

The public were divided in their sentiments of this work: many looked upon the author as a simple visionary or a fool; while he was accused of the black art, or black magic, by others, and treated as an impious person, who held a commerce with the devil: at the same time there were not wanting such, and those in great numbers, who believed him to be really and truly endued with the supernatural gift of prophecy. Lastly, Some were found who remained in suspense, and refrained from giving any judgment at all upon the point. However, Henry II. and Queen Catherine of Medicis his mother, were resolved to see our prophet; and, receiving orders to that effect, he presently repaired to Paris. He was very graciously received at court; and, besides the extraordinary respect that was paid to him, received a present of 200 crowns. He was sent afterwards to Blois, to make a visit to his majesty's children there, and report what he should be able to discover concerning their destinies. No doubt he exerted himself to the utmost on the occasion; but what his sentence was is not known; however, it is certain, he returned to Salon loaded with honour and presents. Animated with his success, he augmented his work from 300 quatrains to the number of a complete milliade, and published it with a dedication to the king in 1558. That prince dying the next year of a wound which he received, as is well known, at a tournament, the book of our prophet was immediately consulted; and in the 35th quatrain of the first century this unfortunate event was found predicted in the following verse:

Le lion jeune le vieux surmontera,
En champ bellique par singulier duel,
Dans cage d'or les yeux lui crevera,
Deux classes une puis mourir, mort cruelle.

So remarkable a prediction added new wings to his fame; and he was honoured shortly after with a visit from Emanuel duke of Savoy and the princess Margaret of France his consort. From this time Nostradamus found himself even overburdened with visitors, and his fame made every day new acquisitions. Charles IX. coming to Salon, was eager above all things to have a sight of him. Nostradamus, who then was in waiting as one of the retinue of the magistrates, being instantly presented to his majesty, complained of the little esteem his countrymen had for him; whereupon the monarch publicly declared, that he should hold the enemies of Nostradamus to be his enemies, and desired to see his children. Nor did that prince's favour stop here; in passing, not long after, through the city of Arles, he sent for Nostradamus, presented him with a purse of 200 crowns,

crowns, together with a brevet, constituting him his physician in ordinary, with the same appointment as the rest. But our prophet enjoyed these honours only for the space of sixteen months, for he died July 2. 1566, at Salon. Besides his "Centuries," we have the following compositions of his: A Treatise *de Fardemens et de Senteurs*, 1552.—A Book of singular Receipts, *pour Entretenir la Santé du Corps*, 1556.—A piece *des Confitures*, 1557.—A French Translation of the Latin of Galen's Paraphrase, exhorting Menedolas to Study, especially to that of Physic, 1552. Some years before his death, he published a small instruction for husbandmen, showing the best seasons for their several labours, which he entitled, The Almanack of Nostradamus. Lastly, After his death there came out The eleventh and twelfth Centuries of his Quatrains, added to the former ten, which had been printed three times in two separate parts. It is only in these first editions that our author's Centuries are found without alterations, additions, &c. It is to this work that the following distich of Stephen Jodelle alludes.

Nostra damus cum falsa damus, nam fallere nostrum est,
Et cum falsa damus, nil nisi Nostra damus.

NOSTRE, Andrew le, comptroller of the buildings of the French king, and designer of his gardens, distinguished himself by carrying the art of laying out gardens to great perfection. He was born at Paris in 1631; and was near 40 years of age when M. Fouquet, superintendant of the finances, gave him an opportunity of becoming known by the fine gardens of Vaux le-Vicomte. He was afterwards employed by Louis XIV. at Versailles, Trianon, St Germains, &c. and discovered an admirable taste in all his works. In 1678 he went to Rome, with the permission of the French king, to improve his skill; but he found nothing there comparable to what he himself had done. Pope Innocent XI. resolved to see Le Nostre, and gave him a pretty long audience; at the conclusion of which Le Nostre said, "I have seen the two greatest men in the world, your holiness, and the king my master." "There is a great difference," answered the pope: "The king is a great victorious prince; and I am a poor priest, the servant of the servants of God." Le Nostre, charmed with this answer, and forgetting who he was with, clapped the pope on the shoulder, saying, "Reverend father, you look extremely well, and will live to bury all the sacred college." The pope laughed at his prediction. Le Nostre, charmed more and more at the goodness of the sovereign pontiff and the singular esteem he showed for the king, threw his arms about the pope's neck and kissed him. It was his custom to behave in the same manner to all who spoke in praise of Louis XIV. and he even embraced the king himself whenever that prince returned from the country. Le Nostre had also a talent for painting. He preserved his good sense and vivacity of mind to the end of his life; and died at Paris, in 1700, aged 87.

NOTÆ, signs used in writing, which have the force of many letters. This contrivance for expedition is of great antiquity. It was known to the Greeks, and from them derived to the Romans. By whom the invention was brought into Rome is not precisely ascertained; but the most general opinion † is, that in matters of importance Tully first made use of notes or short-hand writing, when Cato made an oration in order to oppose Julius Cæsar relative to the conspiracy of Catiline. Cicero, who was at that time consul, placed *notarii*, or expert short-hand writers, in different parts of the senate house, to take down the speech; and this was the first public occasion which we find recorded of employing short-hand writers among the Romans. It is unnecessary to observe, that hence proceeded the name of *notary* still in use.

† Astle's Origin and Progress of Writing.

There were three kinds of notes for short-hand writing used by the ancients, either for despatch or secrecy. The first and most ancient was that of hieroglyphics, which are rather images or representations of things than of words. (See Hieroglyphics). The Chinese characters are of this kind, and may with greater propriety be called *notæ* than *literæ*, as appears from what hath been already advanced.

The second species of notes were called *singulariæ*, from their expressing words by single letters. Sertorius Ursatus has compiled a very copious collection of such abbreviations, of which work there are several editions.

The third kind of notes were called *notæ Tironianæ*, from Tiro the freed man of Cicero, who was excellently skilled in this art; and it is to him that we are indebted for the preservation of Cicero's letters, of which a great part still remain, and one entire book of them written to Tiro himself.

From books it appears, that notes were very frequent among the Romans, and continued in use to the 10th and 11th centuries. We have indeed but few books remaining that are written in short-hand; but this is not surprising, when such was the unhappy situation of early ages, that either superstition condemned them to the flames as the works of impious magicians or necromancers, or they were left to be devoured by vermine, through ignorance and stupidity, which was so very great, that some people, as Trithemius affirms, looked upon notes in those days as the elements of the Armenian language. It is probable, however, that there are writings of this sort still extant, which might contribute to enrich the republic of letters.

There are several MSS. and instruments written in these kind of notæ, in the royal library at Paris. In the year 1747, the learned and ingenious Mons. Charpentier, engraved and published at Paris a capitulary, and 54 charters of Louis the Pious, emperor and king of France, written in these notæ Tironianæ. To this work the learned editor hath prefixed an Alphabetum Tironianum, together with a great number and variety of notes or marks for the different parts of speech, and rules for acquiring the art of writing in these kind of notes. Valerius Probus, in his book *De Literis Antiquis*, explains many of the characters used by the short-hand writers; and there is a dictionary of them set forth by Janus Gruterus. See Stenography.

NOTARII, persons employed by the Romans to take, by *notæ*, trials and pleadings in their courts of judicature, or to write as amanuenses from the mouth of an author. These notarii were of servile condition. Under the reign of Justinian, they were formed into a college or corporate body. Notarii were also appointed to attend the prefects, to transcribe for them. There were likewise *notarii domestici*, who were employed in keeping

keeping the accounts of the Roman nobility; and when the empire became Christian, there were notaries for ecclesiastical affairs, who attested the acts of archbishops, bishops, and other spiritual dignitaries. We find ecclesiastical notaries at Rome, under Pope Julius IV. and in the church of Antioch, about the year 370. From these notaries is derived the office of chancellor to the bishops; afterwards almost every advocate was admitted a notary.

NOTARY (NOTARIUS), signifies a person, usually some scrivener, who takes notes, or frames short draughts, of contracts, obligations, charter parties, or other writings. At present we call him a *notary public*, who publicly attests deeds or writings, in order to make them authentic in another nation: but he is principally employed in business concerning merchants; as making protests of bills of exchange, &c. And noting a bill, is where he goes to take notice of a merchant's refusal to accept or pay the same.

NOTATION, in *Arithmetic* and *Algebra*, the method of expressing numbers or quantities by signs or characters appropriated for that purpose. See ARITHMETIC and ALGEBRA.

NOTES, in *Music*, characters which mark the sounds, i. e. the elevations and fallings of the voice, and the swiftnes and slowness of its motions.

NOTE is likewise used for a mark made in a book or writing, where there occurs something remarkable and worthy of particular notice: as also for an observation or explication of some passage in an author added in the margin, at the bottom of the page, or elsewhere; in which sense it stands contradistinguished to *text*.

NOTE, is also a minute, or short writing, containing some article of business; in which sense we say, promissory note, note of hand, bank note, &c.

NOTHUS, signifies *spurious* or *bastard;* whence it is figuratively applied by physicians to such diseases as, though in respect of a similitude of symptoms, &c. they have the same denomination as some others, yet are of a different origin, seat, or the like, from the same.

NOTHUS a Persian prince, and grandfather to Darius Codomannus. He is worthy of being mentioned only as he was progenitor to that sovereign whose overthrow conferred upon Alexander the title of *Great*.

NOTION, a word which in common language is considered as of the same import with idea. This, however, is improper. Notion comprehends the meaning of idea, but it denotes much more. We have a notion of spirit, of power, of solidity; but of these things we can have no ideas. Ideas are relicks of sensation; but there are objects of knowledge which fall under the cognizance of no sense; of these objects, however, we may have very distinct notions either direct or relative. See METAPHYSICS, N° 11.

NOTITIA, in literary history, a book that gives an account of a particular country, city, or other place: such is the *Notitia Imperii Romani, Notitia Romæ Antiquæ*, &c.

NOTO, an ancient, large, and handsome town of Sicily, and capital of the Val-di-Noto. It was entirely ruined by an earthquake in 1693; but the inhabitants built another town at some distance from it, which they call *Noto Nuovo*. E. Long. 14. 0. N. Lat. 36. 50.

NOTO, *Val di*, one of the three valleys or provinces into which Sicily is divided; and it lies between the sea, Val-di-Demona, and Val-di-Mazara. Noto is the capital town.

NOTONECTA, the boat fly, a genus of insects belonging to the order of hemiptera. See ENTOMOLOGY *Index*.

NOTTEBURG, a town of Russia, in the province of Ingria, seated on an island in the lake Ladoga, at the place where the river Neva proceeds from this lake. It is strong, has a good citadel, and was capital of the province before Petersburg was built. E. Long. 31. 40. N. Lat. 60. 0.

NOTTINGHAMSHIRE, a county of England, bounded on the east by Lincolnshire, on the south-east and south by Leicestershire, on the west by Derbyshire, and on the north and north-west by Yorkshire. It extends in length 48 miles, 25 in breadth, and 110 in compass; containing 560,000 acres, 8 hundreds, 9 market towns, 168 parishes, 450 villages, and in 1811 32,298 houses, and 162,900 inhabitants. No county in England enjoys a pleasanter and healthier air. As for the soil, it differs widely in different parts of the county. Towards the west, where lies the forest of Sherwood, it is sandy; and therefore that part of the county is called by the inhabitants the *Sand:* but the south and east parts, watered by the Trent and the rivulets that fall into it, are clayey; and for that reason are called by the inhabitants the *Clay*. The latter is fruitful both in corn and pasture; but the former produces little besides wood, coal, and some lead. The county has a variety of commodities and manufactures, as wool, leather, tallow, butter, cheese, coal, marl, cattle, malt, liquorice, stockings, glass, earthen wares, and strong ale. The principal rivers are the Trent and Idle. The Trent, whose name is supposed to be derived from the French or Latin word signifying *thirty*, either because it receives thirty smaller rivers, or has thirty different sorts of fish in it, is inferior to no river in England, but the Severn, Thames, and Humber. It enters the county on the south-west, and passes through it to the north-east, where it enters Lincolnshire, and after a long course falls at last into the Humber. The Idle rises in Sherwood forest; and after traversing the northern part of the county, falls into the Trent upon the borders of Yorkshire and Lincolnshire.

The spacious forest of Sherwood lies in the west part of the county, and indeed takes up the greatest part of it. It was formerly so thick, that it was hardly passable; but now it is much thinner. It feeds an infinite number of deer and stags; and has some towns in it, of which Mansfield is the chief. It abounds in coal, and a road lies through it for thirty miles together. Since the reign of King Edward I. the nobility and gentry have had grants of it. It was governed by a great number of officers under the late earl of Chesterfield, chief forester; whose ancestor, Sir John Stanhope, had a grant of it, with liberty to destroy and kill at pleasure, reserving only a hundred deer in the whole walk. The duke of Newcastle is now steward and keeper. See NOTTINGHAMSHIRE, SUPPLEMENT.

NOTTINGHAM, chief town of the above county. It is a handsome town, and a county of itself by charter. The name is derived from the Saxon word *Snottengham*, which signifies *caves*, from the caves and apartments anciently dug in the rocks on which the town stands. These, being soft, easily yield to the spade and pickaxe; whence

Nottingham. whence the townsmen have excellent cellars for the vast quantities of malt liquors made here, and sent, as well as their malt, to most parts of England. The situation of the town is very pleasant, having meadows on one hand, and hills of a gentle easy ascent, on the other, It is well supplied with fuel, both wood and coal, from the forest; and with fish by the Trent, which runs about a mile to the south of it, and has been made navigable for barges: so that they receive by it not only great quantities of cheese from Warwickshire and Staffordshire; but all the heavy goods from the Humber, and even from Hull. Over the Trent is a stately stone bridge of 19 arches, where the river is very large and deep, having received the addition of the Dove, the Derwent, the Irwash, and the Soar, three of them great rivers of themselves, which fall into it after its passing by Burton in Staffordshire.

The town is of great antiquity, and it had formerly a strong castle, in which the Danes, in the time of the heptarchy, held out a siege against Buthred king of Mercia, Alfred, and Ethelred his brother king of the West Saxons.

Soon after the Conquest, William either repaired this fortress, or built a new one on the same spot, in the second year of his reign, probably to secure a retreat on his expedition against Edwin earl of Chester and Morcar earl of Northumberland, who had revolted. He committed the custody of it to William Peverell, his natural son, who has by some been considered as the founder. It stands on a steep rock, at the foot of which runs the river Leen.

Deering, in his history of Nottingham, seems very justly to explode the story of the place called Mortimer's Hole, having been made as a hiding place for him; and from his description of it, shows that it was meant as a private passage to the castle, to relieve it with men or provisions in a siege. He says that it is one continued staircase, without any room, or even a place to sit down on. It was by this passage that Edward III. got into the castle and surprised Mortimer and the queen; and from hence, and his being carried away through it, it has its name.

Edward IV. greatly enlarged the castle, but did not live to complete the buildings he began. Richard III. finished them.

It was granted by James I. to Francis earl of Rutland, who pulled down many of the buildings; but it was still of so much strength, that Charles I. in 1642, pitched on it as the place for beginning his operations of war. He set up his standard, first on the walls of the castle, but in two or three days removed it to a close on the north side of the castle, without the wall, on a round spot; after which it was for many years called Standard close, and since from the name of one who rented it, Nevil's close. Where the standard was fixed, there stood a post for a considerable time. It is a common error that it was erected on a place called Derrymount, a little further north than the close just mentioned; this is an artificial hill, raised on purpose for a wind-mill which formerly stood there. The castle was afterwards sequestered by the parliament, and the trees in the park cut down.

This castle was so strong that it was never taken by storm. After the civil war, Cromwell ordered it to be demolished. On the Restoration, the duke of Buckingham, whose mother was daughter and heir of this Francis earl of Rutland, had it restored to him, and sold it to William Cavendish, marquis and afterwards duke of Newcastle. In 1674 he began the present building, but died in 1676, when the work was not far advanced. However, he had the building of it so much at heart, that he left the revenue of a considerable estate to be applied to that purpose, and it was finished by Henry his son. The expence was about 14,000l. It is one of the seats of the present duke of Newcastle.

In the park, west of the castle, and facing the river Leen, are some remains of an ancient building (if it may be so called) cut and framed in the rock. Dr Stukeley gives it, as he does most things, to the Britons. Many other ancient excavations have been found in other parts of the rocks.

The frames for knitting stockings were invented by one William Lea of this county, about the beginning of the 17th century; but not meeting with the encouragement he expected, he went with several of his workmen to France on the invitation of Henry IV. The death of that king, and the troubles which ensued, prevented attention being given to the work. Lea died there, and most of his men returned to England. Other attempts were made to steal the trade, without better success, and it has flourished here ever since, and is now carried on to a very considerable extent. It is noted for its horse-races on a fine course on the north side of the town. The corporation is governed by a mayor, recorder, six aldermen, two coroners, two sheriffs, two chamberlains, and twenty-four common-council men, eighteen of the senior council, and six of the junior, and a bell-bearer. The population, which in 1801 was 28,861, in 1811 had increased to 34,253. The town being within the jurisdiction of the forest, the former of these pinders is town-woodward, and attends the forest courts. It has three neat churches, the chief of which is St Mary's; and an alms-house, endowed with 100l. a-year, for twelve poor people; with a noble townhouse, surrounded with piazzas. A considerable trade is carried on in glass and earthen wares, and frame stockings, besides the malt, and malt liquors, mentioned above: Marshal Tallard, when a prisoner in England, was confined to this town and county. In the duke of Newcastle's park there is a ledge of rocks hewn into a church, houses, chambers, dove-houses, &c. The altar of the church is natural rock; and between that and the castle there is a hermitage of the like workmanship. Upon the side of a hill there is a very extraordinary sort of a house, where you enter at the garret, and ascend to the cellar, which is at the top of the house. Here is a noted hospital founded by John Plumtree, Esq. in the reign of Richard II. for thirteen poor old widows. There are four handsome bridges over the Trent and Lind. To keep these in repair, and for other public purposes, the corporation has good estates. This town and Winchelsea both give title of earl to the noble family of Finch. Here David king of Scots, when a prisoner in England, resided; and under ground is a vault, called *Mortimer's hole*, because Roger Mortimer, earl of March, is said to have concealed himself in it, when he was taken and hanged by order of Edward III. W. Long. 1. 5. N. Lat. 53. 0.

NOVA SCOTIA. See *Nova SCOTIA*.

NOVA *Zembla*. See *Nova ZEMBLA*.

NOVALLE, a small, rich, and populous town of Italy, between Padua and Treviso. E. Long. 12. 5. N. Lat. 45. 35.

NOVARA, an ancient and strong city of Italy, in that part of the duchy of Milan which belongs to Sardinia. Some pretend that this city was built by the Trojans, and so called *quasi Nova Ara*, because they had erected there a temple to Venus. Tacitus mentions its being made a municipal city by the Romans, and there are many inscriptions still extant, which sufficiently prove its ancient splendour. It is now a small, but well-built town, situated on a little eminence, in a fine country, betwixt two rivers, very well fortified, and is the see of a bishop, suffragan of Milan. It is remarkable for the several sieges sustained in past times, and for being the birthplace of Peter Lombard, master of the sentences. E. Long. 8. 35. N. Lat. 45. 25.

NOVATIAN, who made so much noise and so greatly disturbed the peace of the church, was, we are told, first a Pagan philosopher. He was baptized in bed when dangerously ill: recovering, however, he was afterwards ordained priest of the church of Rome, his bishop having obtained this favour for him, which the clergy and the people were far from being disposed to grant. He does not appear to have had the good of the church much at heart; for with his wit, knowledge, and eloquence, he might have been peculiarly serviceable to her, had he not with cowardice shrunk from his duty when he dreaded persecution. His ambition to be made a bishop likewise misled him; and what occasioned the apostasy of most of the first heresiarchs, also occasioned his. On the death of Fabian bishop of Rome, after writing a letter to St Cyprian, he remained quiet whilst the see was vacant; but the promotion of Cornelius to that dignity excited his envy and jealousy to no common pitch. The consequence was a separation from the new bishop, and from those who professed to believe, what Novatian strenuously denied, that the church could receive those again who had been guilty of idolatry. He soon got a number of followers among the laity, and some even among the clergy. Novatus, a priest of Carthage, was one of his party, and having been a party-man himself against St Cyprian, brought his adherents with him. He got himself consecrated bishop of Rome in a most infamous and clandestine manner, by three weak men, whom he had most grossly imposed upon, and one of whom did penance for having been concerned in what was so contrary to order, decency, and the rules of the church.

His designs, however, in this disgraceful affair did not succeed, for he was not acknowledged as bishop of that diocese; Cornelius being confirmed in it, whilst he was condemned and excommunicated. He still, however, taught his doctrine, and at length became the head of the party which bears his name. Besides the letter mentioned above, St Jerome says he wrote on the *Passover*, on the *Sabbath*, on *Circumcision*, on the *High Priests*, on *Prayer*, on *Jewish meals*, and on *Firmness of mind*, &c. with a large treatise *on the Trinity*. None of them appear under his own name, and some are thought not to be his.

NOVATIANS, *Novatiani*, a sect of ancient heretics, that arose towards the close of the third century, so called from Novatian, a priest of Rome, (see the preceding article). They were called also *Cathari*, from καθαρος, *pure*, q. d. Puritans.

Novatian first separated from the communion of Pope Cornelius, on pretence of his being too easy in admitting to repentance those who had fallen off in times of persecution.

Novatus coming to Rome, joined himself to the faction of Novatian; and both maintained, that there was no other admission into the church but by the repentance in baptism; grounding their opinion on that of St Paul: "It is impossible for those once "enlightened, and who have tasted the heavenly gift, "if they fall away, to renew themselves by repent-"ance."

Not that they denied but a person fallen into any sin, how grievous soever, might obtain pardon by repentance; for they themselves recommend repentance in the strongest terms: but their doctrine was, that the church had it not in its power to receive sinners into its communion, as having no way of remitting sins but by baptism; which once received could not be repeated.

In process of time the *Novatians* softened and moderated the rigour of their master's doctrine, and only refused absolution to very great sinners.

The two leaders were proscribed, and declared heretics, not for excluding penitents from communion, but for denying that the church had a power of remitting sins. See NOVATUS.

NOVATION, or INNOVATION, in the *Civil Law*, denotes the change of one kind of obligation for another; as when a promise is accepted instead of a written obligation.

NOVATUS, a priest of Carthage, in the third century, who, to avoid being punished for a crime, joined with the deacon, named *Felicissimus*, against St Cyprian. He went to Rome in 251; and there found Novatian, who had acquired great reputation by his eloquence, but who murmured at his not being raised to the see of Rome in preference to Cornelius. Novatus contracted a friendship with him; and afterwards promoted the detestable consecration of Novatian to the see of Rome. This irregular consecration produced a very great schism. Novatus also maintained, that the church had not the power to receive those to communion who were fallen into idolatry.

NOVEL, a fictitious narrative in prose, which professes to exhibit the natural workings of the human heart, the happiness and misery of private life, and, above all, the nature of the affection called *Love*, and the consequence of indulging it in certain circumstances.

The novel sprung out of the old romance, and has been censured for insipidity, as its parent was for extravagance. (See ROMANCE). That the greater part of those absurd things, which, under this title, are daily issuing from the press, deserve all the contempt with which they can be treated, is a position which we feel not ourselves inclined to controvert; but we cannot admit that any species of writing is in itself insipid, merely because numbers have attempted it without success. The heroic poems of Blackmore are universally

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versally known to be contemptible performances; and if we had before us all the heroic poetry that has ever been written, how many thousands of volumes should we have as mean as either *Prince Arthur*, *King Arthur*, *Elize*, or *Alfred?* Yet no critic has hitherto dared to maintain, that heroic poetry is an insipid species of writing.

But to the novel objections have been urged of more importance than its insipidity. It has been often affirmed, with learned solemnity, that the perusal of novels tends to corrupt the youth of both sexes; to produce effeminacy in men and extravagant notions of the happiness of love in women; that it diverts the minds of the former from more serious and useful studies, and exposes the latter to the arts of seduction. That there are too many novels to which this objection is applicable in its full force, is a fact which we are afraid cannot be denied: but when it is admitted, let not these performances be again accused of insipidity: for were they insipid, they could have no such consequences. It is by laying fast hold of the heart that they lead it astray. That a novel might be written so as to interest the heart in behalf of virtue, as much as any one has ever warped it to the side of vice, is a truth which no man will ever venture to call in question who has any knowledge of human nature; and therefore we are decidedly of opinion, that there may be novels worthy at once of the perusal of inexperienced youth and hoary wisdom. A critic *, by no means too indulgent to works of fancy, and among whose failings laxity of morals has never been numbered, thus expresses himself on the subject of novel-writing:—"These familiar histories may perhaps be made of greater use than the solemnities of professed morality, and convey the knowledge of vice and virtue with more efficacy than axioms and definitions. But if the power of example is so great, as to take possession of the memory by a kind of violence, and produce effects almost without the intervention of the will, care ought to be taken, that, when the choice is unrestrained, the best examples only should be exhibited; and that what is likely to operate so strongly, should not be mischievous or uncertain in its effects."

* *Johnson.*

We have said, that the novel professes above all things to exhibit the nature of love and its consequences. Whether this be essential to such performances may perhaps be reasonably questioned: but it has been made an important part of the drama in most novels, and, we think, with great propriety. It is the object of the novelist to give a true picture of life, diversified only by accidents that daily happen in the world, and influenced by passions and qualities which are really to be found in conversing with mankind. To accomplish this object, he conceives a hero or heroine, whom he places in a certain rank of life, endues with certain qualities of body and mind, and conducts, through many vicissitudes of fortune, either to the summit of happiness or to the abyss of misery, according to the passion which he wishes to excite in his readers. In the modern novel, this hero or heroine is never placed on a throne, or buried in a cottage; because to the monarch and the cottager no difficulties occur which can deeply interest the majority of readers. But among the virtuous part of the intermediate orders of society, that affection which we call *love* seldom fails, at some period of life, to take possession of the hearts of both sexes; and wherever it has place, it must be productive of happiness or of misery. In the proper management of this passion consists much of the difficulty of the novel writer. He must exhibit his hero as feeling all the pangs and pleasures of love, as sometimes animated with hope, and sometimes ready to sink into despair, but always exerting himself to obtain the gratification of his wishes. In doing this, care should be taken, either that he never transgress the laws of virtue, or at least that he never transgress them with impunity.

"It is justly considered as the greatest excellency of art to imitate nature; but it is necessary to distinguish those parts of nature which are most proper for imitation: greater care is still required in representing life, which is so often discoloured by passion or deformed by wickedness. If the world be promiscuously described, I cannot perceive (says the great critic already quoted) of what use it can be to read the account; or why it may not be as safe to turn the eye immediately upon mankind, as upon a mirror which shows all that presents itself without discrimination. It is therefore not a sufficient vindication of a character, that it is drawn as it appears; for many characters ought never to be drawn: nor of a narrative, that the train of events is agreeable to observation; for that observation which is called knowledge of the world will be found much more frequently to make men cunning than good. The purpose of these writings is surely not only to show mankind, but to provide that they may be seen hereafter with less hazard; to teach the means of avoiding the snares which are laid by TREACHERY for INNOCENCE, without ensuring any wish for that superiority with which the betrayer flatters his vanity; to give the power of counteracting fraud, without the temptation to practise it; to initiate youth by mock encounters in the art of necessary defence; and to increase prudence, without impairing virtue.

"Many writers, for the sake of following nature, so mingle good and bad qualities in their principal personages, that they are both equally conspicuous; and as we accompany them through their adventures with delight, and are led by degrees to interest ourselves in their favour, we lose the abhorrence of their faults, because they do not hinder our pleasures, or perhaps regard them with some kindness for being united with so much merit.—There have been men indeed splendidly wicked, whose endowments threw a brightness on their crimes, and whom scarce any villany made perfectly detestable, because they never could be wholly divested of their excellencies: but such have been in all ages the great corrupters of the world; and their resemblance ought no more to be preserved than the art of murdering without pain.

"In narratives, where historical veracity has no place, there should be exhibited the most perfect idea of virtue; of virtue not angelical, nor above probability (for what we cannot credit we shall never imitate), but the highest and purest that humanity can reach, which, exercised in such trials as the various revolutions of things shall bring upon it, may, by conquering some calamities and enduring others, teach us what we may hope, and what we can perform. Vice (for vice is necessary to be shown) should always disgust; nor should the graces of gaiety, or the dignity of courage, be so united with it, as to reconcile it to the mind. Wherever it appears, it should raise hatred by the malignity of its practices, and contempt by the meanness of its stratagems; for while it is supported by either parts or spirit, it will seldom be heartily abhorred."

If these observations be just, and to us they appear unanswerable, Richardson's *Lovelace* is a character which ought never to have been drawn. In the graces of gaiety and the dignity of courage, in liberality without profusion, in perseverance and address, he everywhere appears as the first of men; and that honour with which he protects the virtue of his *Rosebud*, if any instruction is to be drawn from it, can only lead the admirers of Richardson to believe that another Clarissa might be in perfect safety were she to throw herself upon the honour of another Lovelace. Yet in the composition of this splendid character there is not one principle upon which confidence can securely rest; and Lovelace, whilst he is admired by the youth of both sexes, and escapes the contempt of all mankind, must excite in the breast of the cool moralist sentiments of abhorrence and detestation. A French critic †, speaking of this character, says, "By turns I could embrace and fight with Lovelace. His pride, his gaiety, his drollery, charm and amuse me: his genius confounds me and makes me smile; his wickedness astonishes and enrages me; but at the same time I admire as much as I detest him." Surely this is not the character which ought to be presented to the inexperienced and ardent mind.

† The author of *La jolie femme*, or *La femme du jour.*

The most perfect characters which we at present recollect in any novel are Richardson's Grandison and Fielding's Allworthy. The virtues of the former are perhaps tinctured with moral pedantry, if we may use the expression: and the latter suffered himself to be long imposed upon by the arts of the hypocrite and the philosophical coxcomb; but without some defects they would not be human virtues, and therefore no objects of human imitation. Clarissa is an excellent character: she has as much perfection as can be expected in woman, whilst she exhibits, at the same time, some obvious defects.

As it is the object of the novelist to interest the heart, and to communicate instruction through the medium of pleasure, his work, like a tragedy or comedy, should be one, exhibiting a hero or heroine, whose success every incident should contribute to forward or to retard. In this respect no work of fancy has ever surpassed the Tom Jones of Fielding. It is constructed upon principles of the soundest criticism, and contains not a single event which does not in some way contribute towards the winding up of the piece. A living author, deeply read in Grecian literature, and far from being prejudiced in behalf of any modern, has been heard to say, that had Aristotle seen Tom Jones, he would have pronounced it a poem perfect in its kind.

Against this sentence another critic of name has entered his protest, and strenuously maintained that nothing can be a poem which is not written in verse. We shall judge of the truth of this conclusion by comparing it with the principles from which it is deduced. Having laid down as a maxim incontrovertible, that "the end of poetry is pleasure, to which use itself must be subservient," he very justly infers from this IDEA, that "poetry should neglect no advantage that fairly offers itself, of appearing in such a dress or mode of language as is most taking and agreeable to us. It follows (he says), from the same idea of the *end* which poetry would accomplish, that not only rhythm, but NUMBERS properly so called, is essential to it, and that it cannot obtain its own purpose unless it be clothed in VERSE." He then proceeds to ask, "What, from this conclusion, are we to think of those *novels* or *romances*, as they are called, which have been so current of late through all Europe? As they propose pleasure for their end, and prosecute it, besides, in the way of *fiction*, though without metrical numbers, and generally indeed in harsh and rugged prose, one easily sees what their pretensions are, and under what idea they are ambitious to be received. Yet as they are wholly destitute of measured sounds (to say nothing of their other numberless defects), they can at most be considered but as hasty, imperfect, and abortive poems: whether spawned from the dramatic or narrative species, it may be hard to say.

Unfinish'd things one knows not what to call,
Their generation's so equivocal.

However, such as they are, those *novelties* have been generally well received: *Some* for the real merit of their execution; *others*, for their amusing subjects; all of them for the gratification they afford, or at least promise, to a vitiated, pallid, and sickly imagination, that last disease of learned minds, and sure prognostic of expiring letters. But whatever may be the temporary success of these things (for they vanish as fast as they are produced), good sense will acknowledge no work of art but such as is composed according to the law of its kind."

Of this severe criticism the author himself has given us, what amounts to a complete confutation. He tells us, that the ancients looked for so much force and spirit of expression in whatever they dignified with the name of *poem*, as sometimes to make a question "whether comedy were rightly referred to this class, because it differed only in measure from mere prose? Their doubt (he justly adds) might have been spared or at least resolved, if they had considered that comedy adopts as much of this force and spirit of words as is consistent with the nature and dignity of that pleasure which it pretends to give: For the name of *poem* will belong to every composition whose *primary* end is to please, provided it be so constructed as to afford *all* the pleasure which its kind or sort will permit."

If this decision be just, and we readily admit it, a well composed novel is entitled to the appellation of a *poem*, though it be written in prose and in a style not remarkable for elevation. The business of the novelist is to interest the heart by a display of the incidents of common life. In doing this, he must exhibit scenes that are probable, and record speeches that are natural. He is not at liberty to invent, but only to select, objects, and to cull from the mass of mankind those individuals upon which the attention ought most to be employed. The more closely he adheres to this rule, the more deeply does he interest us in his narrative; because every reader sees at once that it is possible he may at some time or other be in circumstances nearly resembling those of the hero of the tale. But the business of life

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life is not transacted in pompous language, nor the speeches of real lovers made in verse either rhymed or blank. Were *Tom Jones* or *Clarissa Harlowe* to be translated into verse, we shall venture to assert that they would quickly lose their hold of the public mind: because the hero and heroine would then appear in a light which every heart must feel to be unnatural.

It is well observed by Johnson, that the task of the novel writer "requires, together with that learning which is to be gained from books, that experience which can never be attained by solitary diligence, but must arise from general converse and accurate observation of the living world. Their performances have, as Horace expresses it, *plus oneris quantum variæ minus*, little indulgence, and therefore more difficulty. They are engaged in portraits of which every one knows the original, and can detect any deviation from exactness of resemblance. Other writings are safe, except from the malice of learning, but these are in danger from every common reader; as the slipper ill executed was censured by a shoemaker who happened to stop in his way at the Venus of Apelles." It is in thus faithfully copying nature that the excellence of Fielding consists. No man was ever better acquainted with the shades which diversify characters, and none ever made his personages act and speak more like real men and women in the particular circumstances which he describes.

"But the fear of not being approved as a just copier of human manners, is not the most important concern that an author of this class ought to have before him. Novels are written chiefly to the young, the ignorant, and the idle, to whom they serve as lectures of conduct and introduction into life. In every such work, it should therefore be carefully inculcated, that virtue is the highest proof of understanding, and the only solid basis of greatness; and that vice is the natural consequence of narrow thoughts; that it begins in mistake and ends in ignominy: and since love must be introduced, it should be represented as leading to wretchedness, whenever it is separated from duty or from prudence."

Novel, in the civil law, a term used for the constitutions of several emperors, more particularly those of Justinian. They were called *novels*, either from their producing a great alteration in the face of the ancient law, or because they were made on new cases, and after the revisal of the ancient code.

NOVELTY, or Newness. Of all the circumstances that raise emotions, not excepting beauty, nor even greatness, says Lord Kames *, novelty hath the most powerful influence. A new object produces instantaneously an emotion termed *wonder*, which totally occupies the mind, and for a time excludes all other objects. Conversation among the vulgar never is more interesting than when it turns upon strange objects and extraordinary events. Men tear themselves from their native country in search of things rare and new; and novelty converts into a pleasure the fatigues and even perils of travelling. To what cause shall we ascribe these singular appearances? To curiosity undoubtedly: a principle implanted in human nature for a purpose extremely beneficial, that of acquiring knowledge; and the emotion of wonder raised by new and strange objects, inflames our curiosity to know more of such objects. This emotion is different from *admiration*: novelty, wherever found, whether in a quality or action, is the cause of wonder; admiration is directed to the person who performs any thing wonderful.

* *Elements of Criticism.*

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During infancy, every new object is probably the occasion of wonder, in some degree; because, during infancy, every object at first sight is strange as well as new: but as objects are rendered familiar by custom, we cease by degrees to wonder at new appearances, if they have any resemblance to what we are acquainted with; for a thing must be singular as well as new, to raise our wonder. To save multiplying words, we would be understood to comprehend both circumstances when we hereafter talk of novelty.

In an ordinary train of perceptions, where one thing introduces another, not a single object makes its appearance unexpectedly: the mind thus prepared for the reception of its objects, admits them one after another without perturbation. But when a thing breaks in unexpectedly, and without the preparation of any connection, it raises an emotion, known by the name of *surprise*. That emotion may be produced by the most familiar object, as when one unexpectedly meets a friend who was reported to be dead; or a man in high life, lately a beggar. On the other hand, a new object, however strange, will not produce the emotion, if the spectator be prepared for the sight: an elephant in India will not surprise a traveller who goes to see one; and yet its novelty will raise his wonder: an Indian in Britain would be much surprised to stumble upon an elephant feeding at large in the open fields; but the creature itself, to which he was accustomed, would not raise his wonder.

Surprise thus in several respects differs from wonder: unexpectedness is the cause of the former emotion; novelty is the cause of the latter. Nor differ they less in their nature and circumstances, as will be explained by and by. With relation to one circumstance they perfectly agree; which is, the shortness of their duration: the instantaneous production of these emotions in perfection, may contribute to that effect, in conformity to a general law, That things soon decay which soon come to perfection: the violence of the emotions may also contribute; for an ardent emotion, which is not susceptible of increase, cannot have a long course. But their short duration is occasioned chiefly by that of their causes: we are soon reconciled to an object, however unexpected; and novelty soon degenerates into familiarity.

Whether these emotions be pleasant or painful, is not a clear point. It may appear strange, that our own feelings and their capital qualities should afford any matter for a doubt: but when we are engrossed by any emotion, there is no place for speculation; and when sufficiently calm for speculation, it is not easy to recal the emotion with accuracy. New objects are sometimes terrible, sometimes delightful: the terror which a tyger inspires is greatest at first, and wears off gradually by familiarity: on the other hand, even women will acknowledge that it is novelty which pleases the most in a new fashion. It would be rash, however, to conclude, that wonder is in itself neither pleasant nor painful, but that it assumes either quality according to circumstances. An object, it is true, that hath a threatening appearance, adds to our terror by its novelty: but from that experiment it doth not follow, that novelty is in itself disagreeable;

disagreeable; for it is perfectly consistent, that we be delighted with an object in one view, and terrified with it in another. A river in flood swelling over its banks, is a grand and delightful object; and yet it may produce no small degree of fear when we attempt to cross it: courage and magnanimity are agreeable; and yet, when we view these qualities in an enemy, they serve to increase our terror. In the same manner, novelty may produce two effects clearly distinguishable from each other: it may, directly and in itself, be agreeable; and it may have an opposite effect indirectly, which is, to inspire terror; for when a new object appears in any degree dangerous, our ignorance of its powers and faculties affords ample scope for the imagination to dress it in the most frightful colours. The first sight of a lion, for example, may at the same instant produce two opposite feelings, the pleasant emotion of wonder, and the painful passion of terror: the novelty of the object produces the former directly, and contributes to the latter indirectly. Thus, when the subject is analyzed, we find that the power which novelty hath indirectly to inflame terror, is perfectly inconsistent with its being in every circumstance agreeable. The matter may be put in the clearest light, by adding the following circumstance. If a lion be first seen from a place of safety, the spectacle is altogether agreeable without the least mixture of terror. If, again, the first sight puts us within reach of that dangerous animal, our terror may be so great as quite to exclude any sense of novelty. But this fact proves not that wonder is painful: it proves only, that wonder may be excluded by a more powerful passion. Every man may be made certain from his own experience, that wonder raised by a new object that is inoffensive, is always pleasant; and with respect to offensive objects, it appears from the foregoing deduction, that the same must hold as long as the spectator can attend to the novelty.

Whether surprise be in itself pleasant or painful, is a question not less intricate than the former. It is certain that surprise inflames our joy when unexpectedly we meet with an old friend; and not less our terror when we stumble upon any thing noxious. To clear that question, the first thing to be remarked is, that in some instances an unexpected object overpowers the mind, so as to produce a momentary stupefaction: where the object is dangerous, or appears so, the sudden alarm it gives, without preparation, is apt totally to unhinge the mind, and for a moment to suspend all its faculties, even thought itself; in which state a man is quite helpless: and if he move at all, is as like to run upon the danger as from it. Surprise carried to such a height, cannot be either pleasant or painful; because the mind, during such momentary stupefaction, is in a good measure, if not totally, insensible.

If we then inquire for the character of this emotion, it must be where the unexpected object or event produceth less violent effects. And while the mind remains sensible of pleasure and pain, is it not natural to suppose, that surprise, like wonder, should have an invariable character? It would appear, however, that surprise has no invariable character, but assumes that of the object which raises it. Wonder being an emotion invariably raised by novelty, and being distinguishable from all other emotions, ought naturally to possess one constant character. The unexpected appearance of an object, seems not equally entitled to produce an emotion distinguishable from the emotion, pleasant or painful, that is produced by the object in its ordinary appearance: the effect it ought naturally to have, is only to swell that emotion, by making it more pleasant or more painful than it commonly is. And that conjecture is confirmed by experience, as well as by language which is built upon experience: when a man meets a friend unexpectedly, he is said to be agreeably surprised; and when he meets an enemy unexpectedly, he is said to be disagreeably surprised. It appears, then, that the sole effect of surprise is to swell the emotion raised by the object. And that effect can be clearly explained: a tide of connected perceptions glide gently into the mind, and produce no perturbation; but an object breaking in unexpectedly, sounds an alarm, rouses the mind out of its calm state, and directs its whole attention to the object, which, if agreeable, becomes doubly so. Several circumstances concur to produce that effect: on the one hand, the agitation of the mind and its keen attention prepare it in the most effectual manner for receiving a deep impression: on the other hand, the object, by its sudden and unforeseen appearance, makes an impression, not gradually, as expected objects do, but as at one stroke with its whole force. The circumstances are precisely similar where the object is in itself disagreeable (A).

The pleasure of novelty is easily distinguished from that of variety: to produce the latter, a plurality of objects is necessary; the former arises from a circumstance found in a single object. Again, Where objects, whether co-existent or in succession, are sufficiently diversified, the pleasure of variety is complete, though every single object of the train be familiar; but the pleasure of novelty, directly opposite to familiarity, requires no diversification.

There are different degrees of novelty, and its effects are

(A) What Mareschal Saxe terms *le cœur humain*, is no other than fear occasioned by surprise. It is owing to that cause that an ambush is generally so destructive: intelligence of it beforehand renders it perfectly harmless. The Mareschal gives from Cæsar's Commentaries two examples of what he calls *le cœur humain*. At the siege of Amiens by the Gauls, Cæsar came up with his army, which did not exceed 7000 men; and began to entrench himself in such hurry, that the barbarians judging him to be afraid, attacked his entrenchments with great spirit. During the time they were filling up the ditch, he issued out with his cohorts, and by attacking them unexpectedly struck a panic that made them fly with precipitation, not a single man offered to make a stand. At the siege of Alesia, the Gauls, infinitely superior in number, attacked the Roman lines of circumvallation, in order to raise the siege. Cæsar ordered a body of his men to march out silently, and to attack them on the one flank, while he with another body did the same on the other flank. The surprise of being attacked when they expected a defence only, put the Gauls into disorder, and gave an easy victory to Cæsar.

A

are in proportion. The lowest degree is found in objects surveyed a second time after a long interval; and that in this case an object takes on some appearance of novelty, is certain from experience: a large building of many parts variously adorned, or an extensive field embellished with trees, lakes, temples, statues, and other ornaments, will appear new oftener than once: the memory of an object so complex is soon lost, of its parts at least, or of their arrangement. But experience teaches, that, even without any decay of remembrance, absence alone will give an air of novelty to a once familar object; which is not surprising, because familiarity wears off gradually by absence: thus a person with whom we have been intimate, returning after a long interval, appears like a new acquaintance. And distance of place contributes to this appearance, not less than distance of time: a friend, for example, after a short absence in a remote country, has the same air of novelty as if he had returned after a longer interval from a place nearer home: the mind forms a connexion between him and the remote country, and bestows upon him the singularity of the objects he has seen. For the same reason, when two things equally new and singular are presented, the spectator balances between them; but when told that one of them is the product of a distant quarter of the world, he no longer hesitates, but clings to it as the more singular: hence the preference given to foreign luxuries, and to foreign curiosities, which appear rare in proportion to their original distance.

The next degree of novelty, mounting upward, is found in objects of which we have some information at second hand; for description, though it contribute to familiarity, cannot altogether remove the appearance of novelty when the object itself is presented: the first sight of a lion occasions some wonder, after a thorough acquaintance with the correctest pictures and statues of that animal.

A new object that bears some distant resemblance to a known species, is an instance of a third degree of novelty: a strong resemblance among individuals of the same species, prevents almost entirely the effect of novelty, unless distance of place or some other circumstance concur; but where the resemblance is faint, some degree of wonder is felt, and the emotion rises in proportion to the faintness of the resemblanee.

The highest degree of wonder ariseth from unknown objects that have no analogy to any species we are acquainted with. Shakespeare in a simile introduces that species of novelty:

> As glorious to the sight
> As is a winged messenger from heaven
> Unto the white up-turned wond'ring eye
> Of mortals, that fall back to gaze on him,
> When he bestrides the lazy pacing clouds,
> And sails upon the bosom of the air.
>
> *Romeo and Juliet.*

One example of that species of novelty deserves peculiar attention; and that is, when an object altogether new is seen by one person only, and but once. These circumstances heighten remarkably the emotion: the singularity of the spectator concurs with the singularity of the object, to inflame wonder to its highest pitch.

In explaining the effects of novelty, the place a being occupies in the scale of existence, is a circumstance that must not be omitted. Novelty in the individuals of a low class is perceived with indifference, or with a very slight emotion: thus a pebble, however singular in its appearance, scarcely moves our wonder. The emotion rises with the rank of the object; and, other circumstances being equal, is strongest in the highest order of existence; a strange insect affects us more than a strange vegetable; and a strange quadruped more than a strange insect.

However natural novelty may be, it is a matter of experience, that those who relish it the most are careful to conceal its influence. Love of novelty, it is true, prevails in children, in idlers, and in men of shallow understanding: and yet, after all, why should one be ashamed of indulging a natural propensity? A distinction will afford a satisfactory answer. No man is ashamed of curiosity when it is indulged to acquire knowledge. But to prefer any thing merely because it is new, shows a mean taste which one ought to be ashamed of: vanity is commonly at the bottom, which leads those who are deficient in taste to prefer things odd, rare, or singular, in order to distinguish themselves from others. And in fact, that appetite, as above mentioned, reigns chiefly among persons of a mean taste, who are ignorant of refined and elegant pleasures.

Of this taste we have some memorable instances in men of the highest and the best education. Lucian tells the following story of Ptolemy I. which is as disgraceful to him, as honourable to his subjects. This prince had ransacked the world for two curiosities; one was a camel from Bactria all over black; the other a man, half black half white. These he presented to the people in a public theatre, thinking they would give them as much satisfaction as they did him; but the black monster instead of delighting them, affrighted them; and the party-coloured man raised the contempt of some and the abhorrence of others. Ptolemy, finding the Egyptians preferred symmetry and beauty to

A third may be added not less memorable. In the year 846, an obstinate battle was fought between Xamire king of Leon, and Abdoulrahman the Moorish king of Spain. After a very long conflict the night only prevented the Arabians from obtaining a complete victory. The king of Leon, taking advantage of the darkness, retreated to a neighbouring hill, leaving the Arabians masters of the field of battle. Next morning, perceiving that he could not maintain his place for want of provisions, nor be able to draw off his men in the face of a victorious army, he ranged his men in order of battle, and, without losing a moment, marched to attack the enemy, resolving to conquer or die. The Arabians, astonished to be attacked by those who were conquered the night before, lost all heart: fear succeeded to astonishment, the panic was universal, and they all turned their backs without almost drawing a sword.

to the most astonishing productions of art or nature without them, wisely removed his two enormous trifles out of sight; the neglected camel died in a little time, and the man he gave for a song to the musician Thespis.

One final cause of wonder, hinted above, is, that this emotion is intended to stimulate our curiosity. Another, somewhat different, is, to prepare the mind for receiving deep impressions of new objects. An acquaintance with the various things that may affect us, and with their properties, is essential to our well-being: nor will a slight or superficial acquaintance be sufficient; they ought to be so deeply engraved on the mind, as to be ready for use upon every occasion. Now, in order to a deep impression, it is wisely contrived, that things should be introduced to our acquaintance with a certain pomp and solemnity productive of a vivid emotion. When the impression is once fairly made, the emotion of novelty being no longer necessary, vanisheth almost instantaneously; never to return, unless where the impression happens to be obliterated by length of time or other means; in which case the second introduction hath nearly the same solemnity with the first.

Designing wisdom is nowhere more legible than in this part of the human frame. If new objects did not affect us in a very peculiar manner, their impressions would be so slight as scarce to be of any use in life: on the other hand, did objects continue to affect us as deeply as at first, the mind would be totally engrossed with them, and have no room left either for action or reflection.

The final cause of surprise is still more evident than of novelty. Self-love makes us vigilantly attentive to self-preservation; but self-love, which operates by means of reason and reflection, and impels not the mind to any particular object or from it, is a principle too cool for a sudden emergency; an object breaking in unexpectedly, affords no time for deliberation; and in that case, the agitation of surprise comes in seasonably to rouse self-love into action: surprise gives the alarm; and if there be any appearance of danger, our whole force is instantly summoned to shun or to prevent it.

NOVELLARA, a handsome town of Italy, and capital of a small district of the same name, with a handsome castle, where the sovereign resides. E. Long. 10. 37. N. Lat. 45. 50.

NOVEMVIRI, nine magistrates of Athens, whose government lasted but for one year. The first of whom was called *archon*, or prince; the second *basilius*, or king; the third *polemarchus*, or general of the army: the other six were called *thesmothetæ*, or lawgivers. They took an oath to observe the laws; and in case of failure, obliged themselves to bestow upon the commonwealth a statue of gold as big as themselves. Those who discharged their office with honour, were received into the number of the senators of Areopagus.

NOVI, a town of Italy, in the territory of Genoa, on the confines of the Milanese. It was taken by the Piedmontese in 1746. E. Long. 8. 48. N. Lat. 44. 45.

Novi Bazar, a considerable town of Turkey in Europe, and in Servia, near the river Oresco. E. Long. 20. 24. N. Lat. 43. 25.

NOVICE, a person not yet skilled or experienced in an art or profession.

In the ancient Roman militia, *novicii* or *novitii*, were the young raw soldiers, distinguished by this appellation from the veterans.

In the ancient orders of knighthood, there were novices or clerks in arms, who went through a kind of apprenticeship ere they were admitted knights.—See KNIGHT.

NOVICE is more particularly used in monasteries for a religious yet in his, or her, year of probation, and who has not made the vows.

In some convents, the sub-prior has the direction of the novices. In nunneries, the novices wear a white veil; the rest a black one.

NOVICIATE, a year of probation appointed for the trial of religious, whether or no they have a vocation, and the necessary qualities for living up to the rule; the observation whereof they are to bind themselves to by vow. The noviciate lasts a year at least; in some houses more. It is esteemed the bed of the civil death of a novice, who expires to the world by profession.

NOVIGRAD, a small but strong town of Upper Hungary, capital of a county of the same name, with a good castle, seated on a mountain near the Danube. E. Long. 18. 10. N. Lat. 40. 50.

NOVIGRAD, a small but strong town of Dalmatia, with a castle, and subject to the Turks; seated on a lake of the same name, near the gulf of Venice. E. Long. 16. 45. N. Lat. 44. 30.

NOVIGRAD, a very strong place of Servia, subject to the Turks; seated near the Danube. E. Long. 26. 5. N. Lat. 45. 5.

NOVIODUNUM (Cæsar,), a town of the Ædui, commodiously seated on the Liguris: the *Nivernum* of Antonine. Now *Nevers* in the Orleannois, on the Loire.—A second *Noviodunum* of the Aulerci Diablintes, in Gallia Celtica, (Antonine); called *Noviodunum* (Ptolemy), and *Noningentum Rotrudum* by the moderns: *Nogente le Rotrou*, capital of the duchy of Perche.—A third of the Bituriges, (Cæsar): Now *Nueve sur Baranion*; a village 15 miles to the north of Bourges, towards Orleans.—A fourth, of Mœsia Inferior, (Ptolemy), situated on the Ister; now *Nivorz*, in Bessarabia.—A fifth, of Pannonia Superior, (Antonine); now *Gurkfeld* in Carinthia.—A sixth, *Noviodunum Suessionum*, the same with *Augusta Suessionum*.—A seventh, *Noviodunum* of the Veromandui in Gallia Belgica, (Cæsar): now *Noyon* in the Isle of France, on the borders of Picardy.

NOUN, see GRAMMAR, N° 7.; and Chapter I. *in toto*.

NOVOGOROD WELICKI, *Great Novogorod*, according to Mr Coxe, is one of the most ancient cities in Russia. It was formerly called *Great Novogorod*, to distinguish it from other Russian towns of a similar appellation; and now presents to the attentive and intelligent traveller a striking instance of fallen grandeur, According to Nestor, the earliest of the Russian historians, it was built at the same time with Kiof, namely, in the middle of the 5th century, by a Sclavonian horde, who, according to Procopius, issued from the banks of the Volga. Its antiquity is clearly proved

proved by a passage in the Gothic historian Jornandes, in which it is called *Civitas Nova*, or new town. We have little insight into its history before the 9th century, when Ruric the first great duke of Russia reduced it, and made it the metropolis of his vast dominion. The year subsequent to his death, which happened in 879, the seat of government was removed, under his son Igor, then an infant, to Kiof; and Novogorod continued, for above a century, under the jurisdiction of governors nominated by the great dukes, until 970, when Svatoslaf, the son of Igor, created his third son Vladimir duke of Novogorod: the latter, succeeding his father in the throne of Russia, ceded the town to his son Yaroslaf, who in 1036 granted to the inhabitants very considerable privileges, that laid the foundation of that extraordinary degree of liberty which they afterwards gradually obtained. From this period Novogorod was for a long time governed by its own dukes: these sovereigns were at first subordinate to the great dukes, who resided at Kiof and Volodimir; but afterwards, as the town increased in population and wealth, they gradually usurped an absolute independency. Its independency, however, was not perpetual. It continued, indeed, in a flourishing state until the middle of the 15th century: but the great dukes of Russia, whose ancestors had reigned over this town, and who still retained the title of dukes of Novogorod, having transferred their residence from Kiof to Volodimir, and afterwards to Moscow, laid claim to its feudal sovereignty; a demand which the inhabitants sometimes put off by composition, sometimes by resistance, but were sometimes compelled to acknowledge. At length, however, the great duke became absolute sovereign of Novogorod, though the ostensible forms of government were still preserved. It even then, however, continued to be the largest and most commercial city of Russia; a proof of which we have as late as the year 1554, from the following description of Richard Chancellor, who passed through it in 1554 on his way to Moscow. "Next unto Moscow, the city of Novogorod is reputed the chiefest of Russia; for although it be in majesty inferior to it, yet in greatness it goeth beyond it. It is the chiefest and greatest mart town of all Muscovy; and albeit the emperor's seat is not there, but at Moscow, yet the commodiousness of the river, falling into that gulf which is called Sinus Finnicus, whereby it is well frequented by merchants, makes it more famous than Moscow itself." An idea of its population during this period, when compared with its present declined state, is manifest from the fact, that in 1508 above 15,000 persons died of an epidemical disorder; more than double the number of its present inhabitants. In its most flourishing condition it contained at least 400,000 souls. Its ruin was brought on by Ivan Vasilievitch II. and completed by the foundation of Petersburgh, from which it lies about 90 miles south. The present town is surrounded by a rampart of earth, with a range of old towers at regular distances, forming a circumference of scarcely a mile and a half; and even this inconsiderable circle includes much open space, and many houses which are not inhabited. As Novogorod was built after the manner of the ancient towns in this country, in the Asiatic style, this rampart, like that of the Semlainogorod at Moscow, probably enclosed several interior circles. Without it was a vast extensive suburb, which reached to the distance of six miles, and included within its circuit all the convents and churches, the ancient ducal palace and other structures, that now make a splendid but solitary appearance, as they lie scattered in the adjacent plain.

Novogorod stretches on both sides of the Volkof, a beautiful river of considerable depth and rapidity, and somewhat broader than the Thames at Windsor. This river separates the town into two divisions, the trading part, and the quarter of St Sophia, which are united by means of a bridge, partly wooden and partly brick.

Novogorod Welicki, a province of Muscovy, bounded on the north by Ingria; on the east by part of the duchy of Belozero, and that of Tuera, which also bounds it on the south, with the province of Rzeva; and on the west by Plescow. It is full of lakes and forests; however, there are some places which produce corn, flax, hemp, honey, and wax.

Novogorod Serpskoi, a strong town of the Russian empire, and capital of a province of Siberia of the same name, seated on the river Dubiea, in E. Long. 33. 20. N. Lat. 52. 30.

NOVOGORODECK, a town of Lithuania, and capital of a palatinate of the same name. It is a large place, and situated in a vast plain, in E. Long. 25. 30. N. Lat. 53. 45.

NOURISHMENT. See Nutrition.

Nourishment of Vegetables. See Agriculture *Index*.

NOWED, in *Heraldry*, signifies "knotted," from the Latin *nodatus*; being applied to the tails of such creatures as are very long, and sometimes represented in coat armour as tied up in a knot.

NOX, in fabulous history, one of the most ancient deities among the heathens, daughter of Chaos. From her union with her brother Erebus, she gave birth to the Day and the Light. She was also the mother of the Parcæ, Hesperides, Dreams, of Discord, Death, Momus, Fraud, &c. She is called by some of the poets the mother of all things, of gods as well as of men; and she was worshipped with great solemnity by the ancients. She had a famous statue in Diana's temple at Ephesus. It was usual to offer her a black sheep, as she was the mother of the Furies. The cock was also offered to her, as that bird proclaims the approach of day during the darkness of the night. She is represented as mounted on a chariot, and covered with a veil bespangled with stars. The constellations generally went before her as her constant messengers. Sometimes she is seen holding two children under her arms; one of which is black, representing Death, and the other white, representing Sleep. Some of the moderns have described her as a woman veiled in mourning, and crowned with poppies, and carried on a chariot drawn by owls and bats.

NOYON, a town of France, situated on the declivity of a hill on the rivulet Vorse, which at a quarter of a league's distance falls into the Oyse, in the department of Oyse, in E. Long. 3. 0. N. Lat. 49. 38. about 66 miles north-east of Paris. It is an ancient place, being the *Noviodunum Belgarum* of the Latins. It contained 6033 inhabitants in 1800, and is well situated for inland trade, which consists here in wheat and oats, which they send to Paris. They have also

also manufactories of linen cloths, lawns, and tanned leather. There are eight parishes in it, two abbeys, and several monasteries of both sexes. It is the see of a bishop, suffragan to the metropolitan of Rheims; he has the title of count and peer of France, and his income is said to amount to about 15,000 livres per annum. The principal buildings are the episcopal palace, a cloister where the canons of the cathedral dwell, and the town-house. The latter is regularly built in a large square, in the middle of which there is a fountain, where the water conveyed to it from a neighbouring mountain runs continually through three conduits, and is received in a large bason built of very hard stone. They have also many other fountains, several market places, and two public gardens. Noyon is particularly remarkable for the birth of the famous John Calvin, who was born here on the 10th of July 1502, and died at Geneva the 27th of May 1564.

NUAYHAS, the AGUE TREE; a name given by the Indians to a sort of bamboo cane, the leaves of which falling into the water, are said to impregnate it with such virtue, that the bathing in it afterwards cures the ague. They use also a decoction of the leaves to dissolve coagulated blood, giving it internally, and at the same time rubbing the bruised part externally with it. It is said that this plant bears its flowers only once in its life; that it lives 60 years before those make their appearance; but that when they begin to show themselves, it withers away in about a month afterwards; that is, as soon as it has ripened the seed. There seems to be something of fiction in the account of many other particulars relating to this tree in the *Hortus Malabaricus*; but it seems certain, that the length of the stalks, or trunk, must be very great: for, in the gallery of Leyden, there is preserved a cane of it 28 feet long; and another not much shorter in the Ashmolean museum at Oxford, and which is more than eight inches in diameter: yet both these appear to be only parts of the whole trunk, they being nearly as large at one end as at the other.

NUBA, a race of black Pagans, in the neighbourhood of Sennaar, of whom we know nothing but what we have learned from Mr Bruce. That celebrated traveller passed a day or two among them, in his way from Abyssinia; and he tells us, that they are all soldiers of the *Mek* or king of Sennaar, cantoned in villages, which to the distance of four or five miles surround the capital. They are not the aborigines of that part of Africa; but "are either purchased or taken by force from Fazuclo, and the provinces to the south upon the mountains Dyre and Tegla." Though the slaves of a cruel and treacherous master, Mr Bruce represents them as a gentle, honest, and hospitable people; and he says expressly, that on a journey he had seldom passed a more comfortable night, than one in which he took refuge from a storm in a village of those Nuba. He had a good supper, and a clean neat hut to sleep in, while some of the Nuba watched for him all night, and took care of his beasts and his baggage. "Having settlements and provisions given them by the government of Sennaar, as also arms put into their hands, they never wish to desert, but live a very domestic and sober life, and are a much gentler sort of negro than their masters." (See SENNAAR). Though the established religion of Sennaar is that of Mahomet, the government has never attempted to convert the Nuba. On the contrary, a certain number of Pagan priests is maintained for them in every village, who have soldiers in pay to assist them in the affairs of their religion. This is a very singular instance of toleration among Mahometans, and what we should little have expected from such barbarous and sanguinary wretches as those who have the supreme power in Sennaar, had not our observing traveller informed us, that these men themselves know almost nothing of the religion which they profess, and are in their hearts rather Pagans than Mahometans.

The idolatry of the Nuba is described as a mixture of Sabiism and statue worship: but what is very uncommon, their worship is chiefly paid to the moon, while they pay no attention to the sun either rising or setting, advancing to the meridian or receding from it. It is an old observation, that the worship of every people is tinctured by their natural dispositions; and this is verified in the Nuba. "That their worship is performed with pleasure and satisfaction, is obvious (says our author) every night that the moon shines. Coming out from the darkness of their huts, they say a few words upon seeing her brightness, and testify great joy, by motions of their feet and hands, at the first appearance of the new moon." This is just what we should have expected from their gentleness and hospitality. They worship likewise a tree and a stone; but our author could never discover what tree or stone; only he learned that neither of them exists in Sennaar, but in the country where the Nuba are born. Such of them as are natives of the villages where he saw them, become, like their masters, nominal Mahometans.—The rest practise the idolatrous worship of their ancestors, and are much under the influence of their priests, from fear rather than from affection. They are immoderately fond of swine's flesh, and maintain great herds of small hogs, marked with black and white spots. Few of the Nuba advance higher than to be soldiers and officers in their own corps; and the Mek maintains about 12,000 of them near Sennaar to keep the Arabs in subjection. In a climate so violent as that which they inhabit, there is very little need of fuel; and it is happy for them that such is the case, for in the whole country there is not a single tree, or turf, or any thing resembling it. They do not, however, "eat their meat raw like the Abyssinians; but with the stalk of the dora or millet, and the dung of camels, they make ovens under ground, in which they roast their hogs whole, in a very cleanly manner, keeping their skins on till they are perfectly baked. They have neither flint nor steel with which to light their fire at first; but do it in a manner still more expeditious, by means of two sticks, brought, we are led to think, from Sennaar, and there picked out of the river when flooded. They make a small hole in one of these sticks, and point the other: then laying the former in a horizontal position, they apply the point of the latter to the hole; and, turning the perpendicular stick between their hands, as we do a chocolate mill, both sticks take fire and flame in a moment; so perfectly dry and prepared to take fire is every thing there on the surface of the earth."

NUBECULA, Little Cloud, in *Medicine*, a term sometimes used for a disease in the eye, wherein objects appear as through a cloud or mist.

The nubecula seems to arise from certain gross particles detained in the pores of the cornea, or swimming in the aqueous humour, and thus intercepting the rays of light.

Nubecula, or *Nubes*, is also used for what is otherwise called *albugo*. See Albugo.

Nubecula is used likewise for a matter in form of a cloud, suspended in urine.

NUBIA, a kingdom of Africa, bounded on the north by Egypt, on the east by the Red sea and part of Abyssinia, on the west by the kingdoms of Tagua, Gaoga, and the desert of Gerham. The river Nile runs through it; on the banks of which, and those of the other rivers, it is pretty fruitful, but in other places barren, sandy, and in want of water. To the west of the Nile is the desert of Bahouda, which is five days journey over, being the usual road from Egypt to Abyssinia. Money is of no use in this country in the way of trade, it being all carried on by way of exchange. Their bread and drink is made of a small round seed, called *dora* or *seff*, which is very ill tasted. Their houses have mud walls, being very low, and covered with reeds. The habit of the better sort is a vest without sleeves; and they have no coverings for their heads, legs, and feet. The common people wrap a piece of linen cloth about them, and the children go quite naked. They are a stupid debauched sort of people, having neither modesty, civility, nor religion, though they profess to be Mahometans.—The productions of this country are gold, elephants teeth, civet, and sandal wood; and they send a great many slaves into Egypt. The principal towns known to the Europeans are Dangola and Sennaar.

It is famous for a race of horses the most powerful and docile in the world. These animals are generally about sixteen hands high; and by Mr Bruce, who has given the most scientific account of them, they are said to be the breed which was introduced into Nubia at the Saracen conquest, and has been preserved unmixed to this day. Our author represents this as a much nobler animal than the Arabian horse. "What figure (says he*) the Nubian horse would make in point of fleetness is very doubtful, his make being so entirely different from that of the Arabian; but if beautiful symmetry of parts, great size and strength, the most agile, nervous, and elastic movements, great endurance of fatigue, docility of temper, and seeming attachment to men beyond that of any other domestic animal, can promise any thing for a stallion, the Nubian is above all comparison the most eligible in the world." He thinks, and justly thinks, that an attempt should at least be made to import them into this kingdom. "The expence (he says) would not be great, though there might be some trouble and application necessary: but if adroitly managed, there would not be much even of that. The Nubians are very jealous in keeping up the pedigree of their horses, which are black or white, but a vast proportion of the former to the latter." Our author never saw the colour which we call gray, i. e. dappled; but he has seen some bright bays, and some inclined to sorrel. All noble horses in Nubia are said to be descended of one of the five upon which Mahomet and his four immediate successors, Abu Becr, Omar, Atmen, and Ali, fled from Mecca to Medina the night of the Hegira. No one will pay much regard to this legendary tale, or believe that the strength and beauty of this breed of horses is owing to any virtue communicated to the first of them by the prophet and his apostles. Mr Bruce accounts for their excellence upon rational principles "The best horses of the Arabian breed are found (he says) in the tribe of Mowelli and Annecy, which is about 36° north latitude. Dangola, which is in 20° latitude, seemed to him to be the centre of excellence for this noble animal." Hence he infers, that the bounds in which the horse is in greatest perfection, are between the 20th and 36th degrees of latitude, and between 30 degrees of longitude east from Greenwich and the banks of the Euphrates. If to the effects of climate we add the manner of feeding the Nubian horses, we shall perhaps have the true cause of their superiority over all others. "They are kept fat upon dora, and suffered to eat nothing green but the short roots of grass that are to be found by the side of the Nile, after the sun has withered it. This is dug out where it is covered with earth, and appears blanched, and laid in small heaps once a-day on the ground before them."

* Travels, vol. iv. b. 8. ch. 10.

NUBIAN desert, a vast tract of barren rocks and burning sands, extending from Syene in Upper Egypt to Geon, the capital of Berber in Nubia. As Syene is in latitude 24° 0′ 45″ north, and Geon in latitude 17° 57′ 22″, the length of this desert from north to south is 6° 3′ 23″, or upwards of 420 English miles. Its breadth from east to west has not, as far as we know, been precisely ascertained. Through this horrid region, where nothing is to be seen which has the breath of life, must all travellers pass from Sennaar to Egypt; in danger every moment of perishing by thirst, being overwhelmed by moving columns of sand, suffocated by a hot and poisonous wind, or cut in pieces by troops of wandering Arabs. The last European of whom we have heard that made the journey and lived to give an account of it, is Mr Bruce; and the person must have neither taste nor sensibility who can read unmoved his manly narrative.

No single traveller, nor even a caravan, can enter with safety into this desert, but under the protection of a Hybear; whose title and office are thus explained by Mr Bruce: "A Hybear is a guide, from the Arabic word *Hubbar*, which signifies to inform, instruct, or direct, because they are used to do this office to the caravans travelling through the desert in all directions. They are men of great consideration, knowing perfectly the situation and properties of all kinds of water to be met with on the route; the distance of wells, whether occupied by enemies or not; and if so, the way to avoid them with the least inconvenience. It is also necessary that they should know the places occupied by the Simoom, and the seasons of its blowing (see Simoom), as well as those occupied by moving sands."—Under the conduct of one of these men, Mr Bruce, with infinite fortitude and address, passed through the desert in the year 1772, surmounting dangers at which one shudders in his closet. Of these, the following, which we shall give in the nervous language of the author, may serve as an instance.

"We were here (at a place called *Waadi al Halboub*)

at

at once surprised and terrified by a sight surely one of the most magnificent in the world. In that vast expanse of desert, from W. to NW. of us, we saw a number of prodigious pillars of sand at different distances, at times moving with great celerity, at others stalking on with a majestic slowness. At intervals we thought they were coming in a very few minutes to overwhelm us; and small quantities of sand did actually more than once reach us. Again they would retreat so as to be almost out of sight; their tops reaching to the very clouds. There the tops often separated from the bodies; and these once disjoined, dispersed in the air, and did not appear more. Sometimes they were broken in the middle as if struck with a large cannon shot. About noon they began to advance with considerable swiftness upon us, the wind being very strong at north. Eleven of them ranged alongside of us about the distance of three miles. The greatest diameter of the largest appeared to me at that distance as if it would measure 10 feet. They retired from us with a wind at SE. leaving an impression upon my mind to which I can give no name; though surely one ingredient in it was fear, with a considerable degree of wonder and astonishment."

If it be true, as the author of A Philosophical Inquiry into the Origin of our Ideas of the Sublime and Beautiful affirms, that "the passion raised by the sublime is astonishment, and that astonishment is that state of the soul in which all its motions are suspended with some degree of horror," surely a more sublime spectacle was never presented to mortal eyes, than that which was on this occasion presented to Mr Bruce. It must have been awfully majestic; but few, we believe, would choose the pleasure of contemplating such a scene of magnificence at the hazard of that dreadful death with which at every moment it threatened our traveller and his attendants. He, indeed, had firmness of mind to stand still and admire it; but his companions shrieked out; while some of them exclaimed that it was the day of judgment, and others that it was hell or the world set on fire. But for a more particular account of this phenomenon, as well as of the nature of the desert and the proper way of passing it, we must refer to the work from which this short sketch is taken*.

* *Bruce's Travels*, vol. iv.

NUCLEUS, in general, denotes the kernel of a nut, or even any seed enclosed within a husk. The term *nucleus* is also used for the body of a comet, otherwise called its *head*.

NUCTA, a dew, which falling in Egypt about St John's day, is by the superstitious natives of the country considered as miraculous, and the peculiar gift of that saint. Its effects are indeed so beneficial, that this belief is little surprising among a people so totally ignorant of natural causes as the modern Egyptians; for it is acknowledged, by the most enlightened travellers, to stop the plague, and announce a speedy and plentiful inundation of the country. These effects are thus rationally accounted for by Mr Bruce.

"In February and March, the sun is on its approach to the zenith of one extremity of Egypt, and of course has a very considerable influence upon the other. The Nile having now fallen low, the water in certain old cisterns, which, though they still exist, are suffered to accumulate all the filth of the river, becomes putrid, and the river itself has lost all its finer and volatile parts by the continued action of a vertical sun; so that instead of being subject to evaporation, it grows daily more and more inclined to putrefaction. About St John's day it receives a plentiful mixture of the fresh and fallen rain from Ethiopia, which dilutes and refreshes the almost corrupted river, and the sun near at hand exerts its influence upon the water, which is now become light enough to be exhaled, though it has still with it a mixture of the corrupted fluid. It is in February, March, or April only, that the plague begins in Egypt." Our philosophical traveller does not believe it an endemical disease; but assigns very sufficient reasons for thinking that it comes from Constantinople with merchandise or with passengers at the very time of the year when the air, by the long absence of dews, has attained a degree of putridity proper to receive it. In this state of the atmosphere, the infection continues to rage till the period of St John's day, when it is suddenly stopped by the dews occasioned by a refreshing mixture of rain water, which is poured into the Nile at the beginning of the inundation. The first and most remarkable sign of the change effected in the air, is the sudden stopping of the plague. Every person, though shut up from society for months before, buys, sells, and communicates with his neighbour without any sort of apprehension; and as far as our author could learn upon fair inquiry, it was never known that one fell sick of the plague after the anniversary of St John. He admits that some have died of it after that period; but of them the disease had got such hold, under the most putrid influence of the air, that they could not recover. To corroborate this theory, which attributes so much to the benign influence of the falling dew, he observes, that immediately after St John's day, the clothes of the many thousands who have died during the late continuance of the plague are publicly exposed in the market place; and that all these, though consisting of furs, cotton, silk, and woollen cloths, which are the stuffs most retentive of infection, imbibing the moist air of the evening and the morning, are handled, bought, put on and worn, without any apprehension of danger, and without a single accident being known to have happened to any one possessed of this happy confidence.

NUDITIES, in painting and sculpture, those parts of a human figure which are not covered with any drapery; or those parts where the carnation appears.

NULLITY, in *Law*, signifies any thing that is null or void: thus there is a nullity of marriage, where persons marry within the degrees, or where infants marry without consent of their parents or guardians.

NUMA POMPILIUS, the fourth son of Pompilius Pompo, an illustrious Sabine. He had married Tatia, the daughter of King Tatius, and together with her remained in his native country, preferring the tranquillity of a private life to the splendour of a court. Upon the death of his wife, with whom he had lived thirteen years, he gave himself up entirely to the study of wisdom; and, leaving the city of Cures, confined himself to the country, wandering from solitude to solitude, in search only of those woods and fountains which religion had made sacred. His recluse life gave rise to the fable, which was very early received among the Sabines, that Numa lived in familiarity with the nymph Egeria. Upon the death of Romulus, both the senate

senate and people strongly solicited him to be their king. They despatched Julius Proculus and Valerius Volesus, two senators of distinction, to acquaint Numa with their resolution, and make him an offer of the kingdom. The Sabine philosopher rejected at first their proposal; but being at last prevailed upon by the arguments and entreaties of the deputies, joined with those of his father and of Martius his near relation, he yielded; and having offered sacrifices to the gods, set out for Rome, where he was received by all ranks of people with loud shouts of joy. Spurius Vettius, the interrex for the day, having assembled the curiæ, he was elected in due form, and the election was unanimously confirmed by the senate.

The beginning of his reign was popular; and he dismissed the 300 bodyguards which his predecessor had kept around his person, and observed, that he did not distrust a people who had compelled him to reign over them. He was not, like Romulus, fond of war and military expeditions, but he applied himself to tame the ferocity of his subjects, to inculcate in their minds a reverence for the Deity, and to quell their dissensions by dividing all the citizens into different classes. He established different orders of priests, and taught the Romans not to worship the Deity by images; and from his example no graven or painted statues appeared in the temples or sanctuaries of Rome for the space of 160 years. He encouraged the report that was spread of his paying regular visits to the nymph Egeria, and made use of her name to give sanction to the laws and institutions which he had introduced. He established the college of the vestals, and told the Romans that the safety of the empire depended upon the preservation of the sacred *ancyle* or shield, which, as was generally believed, had dropped from heaven. He dedicated a temple to Janus, which, during his whole reign, remained shut as a mark of peace and tranquillity at Rome. After a reign of 42 years, in which he had given every possible encouragement to the useful arts, and in which he had cultivated peace, Numa died in the year of Rome 82. Not only the Romans, but also the neighbouring nations, were eager to pay their last offices to a monarch whom they revered for his abilities, moderation, and humanity. He forbade his body to be burnt according to the custom of the Romans; but he ordered it to be buried near Mount Janiculum, with many of the books which he had written. These books were accidentally found by one of the Romans, about 400 years after his death; and as they contained nothing new or interesting, but merely the reasons why he had made innovations in the form of worship and in the religion of the Romans, they were burnt by order of the senate. He left behind him one daughter called Pompilia, who married Numa Marcius, and became the mother of Ancus Marcius the fourth king of Rome. Some say that he had also four sons; but this opinion is ill founded. The principal laws of King Numa, mentioned by different authors, are, 1. That the gods should be worshipped with corn and a salted cake. 2. That whoever knowingly killed a free man, should be held as a parricide. 3. That no harlot should touch the altar of Juno; and if she did, that she should sacrifice a ewe-lamb to that goddess, with dishevelled hair. 4. That whoever removed a land-mark should be put to death. 5. That wine should not be poured on a funeral pile, &c.

NUMANTIA, a very noble city, the ornament of the Hither Spain, (Florus); celebrated for the long war of 20 years which it maintained against the Romans. The baseness and injustice of the Romans during this war were truly disgraceful to them, and altogether unworthy of a great and powerful people. The inhabitants obtained some advantages over the Roman forces, till Scipio Africanus was empowered to finish the war and to see the destruction of Numantia. He began the siege, with an army of 60,000 men, and was bravely opposed by the besieged, who were no more than 4000 men able to bear arms. Both armies behaved with uncommon valour, and the courage of the Numantines was soon changed into despair and fury. Their provisions began to fail, and they fed upon the flesh of their horses, and afterwards on that of their dead companions, and at last they were obliged to draw lots to kill and devour one another. The melancholy situation of their affairs obliged them to surrender to the Roman general. Scipio demanded them to deliver themselves up on the morrow; they refused, and when a longer time had been granted to their petitions, they retired and set fire to their houses and destroyed themselves, so that not even one remained to adorn the triumph of the conqueror. Some historians, however, deny that; and assert, that a number of Numantines delivered themselves into Scipio's hands, and that 50 of them were drawn in triumph at Rome, and the rest sold as slaves. The fall of Numantia was more glorious than that of Carthage or Corinth, though the place was much inferior to them. It was taken by the Romans, A. U. C. 629; and the conqueror obtained the surname of *Numanticus*.

NUMBER, an assemblage of several units, or things of the same kind. See ARITHMETIC, and METAPHYSICS, N° 205—208.

Number, says Malcolm, is either abstract or applicate: Abstract, when referred to things in general, without attending to their particular properties; and applicate, when considered as the number of a particular sort of things, as yards, trees, or the like.

When particular things are mentioned, there is always something more considered than barely their numbers; so that what is true of numbers in the abstract, or when nothing but the number of things is considered, will not be true when the question is limited to particular things: for instance, the number two is less than three; yet two yards is a greater quantity than three inches: and the reason is, because regard must be had to their different natures as well as number, whenever things of a different species are considered; for though we can compare the number of such things abstractedly, yet we cannot compare them in any applicate sense. And this difference is necessary to be considered, because upon it the true sense, and the possibility or impossibility, of some questions depend.

Number is unlimited in respect of increase; because we can never conceive a number so great but still there is a greater. However, in respect of decrease, it is limited; unity being the first and least number, below which therefore it cannot descend.

Number.

Kinds and distinctions of NUMBERS. Mathematicians, considering number under a great many relations, have established the following distinctions.

Broken numbers are the same with fractions.

Cardinal numbers are those which express the quantity of units, as 1, 2, 3, 4, &c. whereas ordinal numbers are those which express order, as 1st, 2d, 3d, &c.

Compound number, one divisible by some other number besides unity; as 12, which is divisible by 2, 3, 4, and 6. Numbers, as 12 and 15, which have some common measure besides unity, are said to be compound numbers among themselves.

Cubic number is the product of a square number by its root: such is 27, as being the product of the square number 9 by its root 3 All cubic numbers, whose root is less than 6, being divided by 6, the remainder is the root itself; thus 27÷6 leaves the remainder 3, its root; 215, the cube of 6, being divided by 6, leaves no remainder; 343, the cube of 7, leaves a remainder 1, which added to 6, is the cube root; and 512, the cube of 8, divided by 6, leaves a remainder 2, which added to 6, is the cube root. Hence the remainders of the divisions of the cubes above 216, divided by 6, being added to 6, always give the root of the cube so divided till that remainder be 5, and consequently 11, the cube root of the number divided. But the cubic numbers above this being divided by 6, there remains nothing, the cube root being 12. Thus the remainders of the higher cubes are to be added to 12 and not to 6, till you come to 18, when the remainder of the division must be added to 18; and so on *ad infinitum.*

Determinate number is that referred to some given unit, as a ternary or three: whereas an indeterminate one is that referred to unity in general, and is called *quantity.*

Homogeneal numbers are those referred to the same unit; as those referred to different units are termed *heterogeneal.*

Whole numbers are otherwise called *integers.*

Rational number is one commensurable with unity; as a number, incommensurable with unity, is termed *irrational*, or a *surd.*

In the same manner, a rational whole number is that whereof unity is an aliquot part; a rational broken number, that equal to some aliquot part of unity; and a rational mixed number, that consisting of a whole number and a broken one.

Even number, that which may be divided into two equal parts without any fraction, as 6, 12, &c. The sum, difference, and product, of any number of even numbers, is always an even number.

An evenly even number, is that which may be measured, or divided, without any remainder, by another even number, as 4 by 2.

An unevenly even number, when a number may be equally divided by an uneven number, as 20 by 5.

Uneven number, that which exceeds an even number, at least by unity, or which cannot be divided into two equal parts, as 3, 5, &c.

The sum or difference of two uneven numbers makes an even number; but the factum of two uneven ones makes an uneven number.

If an even number be added to an uneven one, or if the one be subtracted from the other; in the former case the sum, in the latter the difference, is an uneven number: but the factum of an even and uneven number is even.

The sum of any even number of uneven numbers is an even number; and the sum of any uneven number of uneven numbers is an uneven number.

Primitive or prime numbers are those divisible only by unity, as 5, 7, &c. And prime numbers among themselves, are those which have no common measure besides unity, as 12 and 19.

Perfect number, that whose aliquot parts added together make the whole number, as 6, 28; the aliquot parts of 6 being 3, 2, and 1, =6; and those of 28, being 14, 7, 4, 2, 1, =28.

Imperfect numbers, those whose aliquot parts added together make either more or less than the whole. And these are distinguished into abundant and defective: an instance in the former case is 12, whose aliquot parts 6, 4, 3, 2, 1, make 16; and in the latter case 16, whose aliquot parts 8, 4, 2, and 1, make but 15.

Plane number, that arising from the multiplication of two numbers, as 6, which is the product of 3 by 2; and these numbers are called the *sides of the plane.*

Square number is the product of any number multiplied by itself; thus 4, which is the factum of 2 by 2, is a square number.

Even square number added to its root makes an even number.

Figurate numbers, are such as represent some geometrical figure, in relation to which they are always considered; as triangular, pentagonal, pyramidal, &c. numbers.

Figurate numbers, are distinguished into orders, according to their place in the scale of their generation, being all produced one from another, viz. by adding continually the terms of any one, the successive sums are the terms of the next order, beginning from the first order which is that of equal units 1, 1, 1, 1, &c.; then the 2d order consists of the successive sums of those of the 1st order, forming the arithmetical progression 1, 2, 3, 4, &c; those of the third order are the successive sums of those of the 2d, and are the triangular numbers 1, 3, 6, 10, 15, &c.; those of the fourth order are the successive sums of those of the 3d, and are the pyramidal numbers 1, 4, 10, 20, 35, &c.; and so on as below:

Order.	*Names.*	*Numbers.*				
1.	Equals,	1,	1,	1,	1,	1, &c.
2.	Arithmeticals,	1,	2,	3,	4,	5, &c.
3.	Triangulars,	1,	3,	6,	10,	15, &c.
4.	Pyramidals,	1,	4,	10,	20,	35, &c.
5.	2d Pyramidals,	1,	5,	15,	35,	70, &c.
6.	3d Pyramidals,	1,	6,	21,	56,	126, &c.
7.	4th Pyramidals,	1,	7,	28,	84,	210, &c.

The above are all considered as different sorts of triangular numbers, being formed from an arithmetical progression whose common difference is 1. But if that common difference be 2, the successive sums will be the series of square numbers: if it be 3, the series will be pentagonal numbers, or pentagons; if it be 4, the series will be hexagonal numbers, or hexagons; and so on. Thus:

4

Arithmeticals.

Arithmeticals.	1st Sums, or Polygons.	2d Sums, or 2d Polygons.
1, 2, 3, 4,	Tri. 1, 3, 6, 10	1, 4, 10, 20
1, 3, 5, 7,	Sqrs. 1, 4, 9, 16	1, 5, 14, 30
1, 4, 7, 10,	Pent. 1, 5, 12, 22	1, 6, 18, 40
1, 5, 9, 13, &c.	Hex. 1, 6, 15, 28	1, 7, 22, 50

And the reason of the names triangles, squares, pentagons, hexagons, &c. is, that those numbers may be placed in the form of these regular figures or polygons.

But the figurate numbers of any order may also be found without computing those of the preceding orders; which is done by taking the successive products of as many of the terms of the arithmeticals, 1, 2, 3, 4, 5, &c. in their natural order, as there are units in the number which denominates the order of figurates required, and dividing those products always by the first product: thus, the triangular numbers are found by dividing the products 1×2, 2×3, 3×4, 4×5, &c. each by the 1st pr. 1×2; the first pyramids by dividing the products $1\times2\times3$, $2\times3\times4$, $3\times4\times5$, &c. by the first $1\times2\times3$. And, in general, the figurate numbers of any order n, are found by substituting successively 1, 2, 3, 4, 5, &c. instead of x in this general expression $\frac{x\,.\,x+1\,.\,x+2\,.\,x+3\,.\,\&c.}{1\,.\,2\,.\,3\,.\,4\,.\,\&c.}$; where the factors in the numerator and denominator are supposed to be multiplied together, and to be continued till the number in each be less by 1 than that which expresses the order of the figurates required. See Maclaurin's Fluxions, art. 351, in the notes; also Simpson's Algebra, p. 213; or Malcolm's Arithmetic, p. 396, where the subject of figurates is treated in a very extensive and perspicuous manner. *Hutton's Mathematical Dictionary.*

Polygonal or polygonous numbers, the sums of arithmetical progressions beginning with unity: these, where the common difference is 1, are called *triangular numbers;* where 2, *square numbers;* where 3, *pentagonal numbers;* where 4, *hexagonal numbers;* where 5, *heptagonal numbers*, &c.

Pyramidal numbers, the sums of polygonous numbers, collected after the same manner as the polygons themselves, and not gathered out of arithmetical progressions, are called *first pyramidal numbers;* the sums of the first pyramidals are called *second pyramidals*, &c.

If they arise out of triangular numbers, they are called *triangular pyramidal numbers;* if out of pentagons, *first pentagonal pyramidals.*

From the manner of summing up polygonal numbers, it is easy to conceive how the prime pyramidal numbers are found, viz. $\frac{(a-2)n^3+3n^2-(a-5)n}{6}$ expresses all the prime pyramidals.

The number nine has a very curious property, its products always composing either 9 or some lesser product of it. We have already given an account of this, with the examples from Hume, under the article Nine; and we need not repeat them. Did our limits permit us, we could instance in a variety of other numbers properties both curious and surprising. Such speculations are indeed by some men considered as trifling and useless: but perhaps they judge too hastily; for few employments are more innocent, none more ingenious, nor, to those who have a taste for them, more amusing.

Numbers were by the Jews, as well as the ancient Greeks and Romans, expressed by letters of the alphabet: hence we may conceive how imperfect and limited their arithmetic was, because the letters could not be arranged in a series, or in different lines, conveniently enough for the purposes of ready calculation. The invention of the cypher, or arithmetical figures, which we now make use of, has given us a very great advantage over the ancients in this respect.

Mankind we may reasonably suppose, first reckoned by their fingers, which they might indeed do in a variety of ways. From this digital arithmetic, very probably, is owing the number 10, which constitutes the whole set of arithmetical figures.

The letters chiefly employed by the Romans to express numbers were, M, for 1000; D, for 500; C, for 100; L, for 50; V, for 5; X, for 10; and I, for one.—M, probably signified 1000, because it is the initial of *mille;* D stands for 500, because it is *dimidium mille;* C signifies 100, as being the first letter of the word *centum;* L stands for 50, because it is the half of C, having formerly been wrote thus ∟; V signifies 5, because V is the fifth vowel; X stands for 10, because it contains twice V or V in a double form; I stands for one, because it is the first letter of *initium.* These however are fanciful derivations. See Numeral *Letters.*

The Jewish cabbalists, the Grecian conjurors, and the Roman augurs, had a great veneration for particular numbers, and the result of particular combinations of them. Thus three, four, six, seven, nine, ten, are full of divine mysteries, and of great efficacy.

Golden Number. See Chronology, N° 27.

Numbers, in *Poetry, Oratory*, &c. are certain measures, proportions, or cadences, which render a verse, period, or song, agreeable to the ear.

Poetical numbers consist in a certain harmony in the order, quantities, &c. of the feet and syllables, which make the piece musical to the ear, and fit for singing, for which all the verses of the ancients were intended. See Poetry.—It is of these numbers Virgil speaks in his ninth Eclogue, when he makes Lycidas say, *Numeros memini, si verba tenerem;* meaning, that although he had forgot the words of the verses, yet he remembered the feet and measure of which they were composed.

Rhetorical or prosaic numbers are a sort of simple unaffected harmony, less glaring than that of verse, but such as is perceived and affects the mind with pleasure.

The numbers are that by which the style is said to be easy, free, round, flowing, &c. Numbers are things absolutely necessary in all writing, and even in all speech. Hence Aristotle, Tully, Quintilian, &c. lay down abundance of rules as to the best manner of intermixing dactyles, spondees, anapests, &c. in order to have the numbers perfect. The substance of what they have said, is reducible to what follows: 1. The style becomes numerous by the alternate disposition and temperature of long and short syllables, so as that the multitude of short ones neither render it too hasty, nor that of long ones

too

Numbers, Numeral.

too slow and languid: sometimes, indeed, long and short syllables are thrown together designedly without any such mixture, to paint the slowness or celerity of any thing by that of the numbers; as in these verses of Virgil:

Illi inter sese magna vi brachia tollunt;

and

Radit iter liquidum, celeres neque commovet alas.

2. The style becomes numerous, by the intermixing words of one, two, or more syllables; whereas the too frequent repetition of monosyllables renders the style pitiful and grating. 3. It contributes greatly to the numerousness of a period, to have it closed by magnificent and well-sounding words. 4. The numbers depend not only on the nobleness of the words in the close, but of those in the whole tenor of the period. 5. To have the period flow easily and equally, the harsh concurrence of letters and words is to be studiously avoided, particularly the frequent meeting of rough consonants; the beginning the first syllable of a word with the last of the preceding; the frequent repetition of the same letter or syllable; and the frequent use of the like ending words. Lastly, The utmost care is to be taken, lest, in aiming at oratorial numbers, you should fall into poetical ones; and instead of prose, write verse.

Book of Numbers, the fourth book of the Pentateuch, taking its denomination from its numbering the families of Israel.

A great part of this book is historical, relating to several remarkable passages in the Israelites march through the wilderness. It contains a distinct relation of their several movements from one place to another, or their 42 stages through the wilderness, and many other things, whereby we are instructed and confirmed in some of the weightiest truths that have immediate reference to God and his providence in the world.—But the greatest part of this book is spent in enumerating those laws and ordinances, whether civil or ceremonial, which were given by God, but not mentioned before in the preceding books.

NUMERAL letters, those letters of the alphabet which are generally used for figures; as I, one; V, five; X, ten; L, fifty; C, a hundred; D, five hundred; M, a thousand, &c.

It is not agreed how the Roman numerals originally received their value. It has been supposed, as we have observed in the end of the article Number, that the Romans used M to denote 1000, because it is the first letter of *mille*, which is Latin for 1000; and C to denote 100, because it is the first letter of *centum*, which is Latin for 100. It has also been supposed, that D, being formed by dividing the old M in the middle, was therefore appointed to stand for 500, that is, half as much as the M stood for when it was whole; and that L being half a C, was, for the same reason, used to denominate 50. But what reason is there to suppose, that 1000 and 100 were the numbers which letters were first used to express? And what reason can be assigned why D, the first letter in the Latin word *decem*, ten, should not rather have been chosen to stand for that number, than for 500, because it had a rude resemblance to half an M?—But if these questions could be satisfactorily answered, there are other numeral letters which have never yet been accounted for at all. These considerations render it probable that the Romans, did not, in their original intention, use letters to express numbers at all; the most natural account of the matter seems to be this:

Numera

The Romans probably put down a single stroke, I, for one, as is still the practice of those who score on a slate or with chalk: this stroke, I, they doubled, trebled, and quadrupled, to express 2, 3, and 4: thus, II. III. IIII. So far they could easily number the strokes with a glance of the eye. But they presently found, that if more were added, it would soon be necessary to tell the strokes one by one: for this reason then, when they came to 5, they expressed it by joining two strokes together in an acute angle thus, V; which will appear the more probable, if it be considered that the progression of the Roman numbers is from 5 to 5, i. e. from the fingers on one hand to the fingers on the other.—Ovid has touched upon the original of this in his *Fastorum*, lib. iii. and *Vitruvius* has made the same remark.

After they had made this acute angle V. for five, they added the single strokes to it to the number of 4, thus, VI. VII. VIII. VIIII. and then as the strokes could not be further multiplied without confusion, they doubled their acute angle by prolonging the two lines beyond their intersection thus, X, to denote two fives, or ten. After this they doubled, trebled, and quadrupled, this double acute angle thus, XX. XXX. XXXX. they then, for the same reason which induced them first to make a single and then to double it, joined two single strokes in another form, and instead of an acute angle, made a right angle L, to denote fifty. When this 50 was doubled, they then doubled the right angle thus ⊏, to denote 100, and having numbered this double right angle four times, thus ⊏⊏ ⊏⊏⊏ ⊏⊏⊏⊏; when they came to the fifth number, as before, they reverted it, and put a single stroke before it thus I⊐, to denote 500; and when this 500 was doubled, then they also doubled their double right angle, setting two double right angles opposite to each other, with a single stroke between them, thus ⊏I⊐ to denote 1000: when this note for 1000 had been four times repeated, then they put down I⊐⊐ for 5000, ⊏⊏I⊐⊐ for 10,000, and I⊐⊐⊐ for 50,000, and ⊏⊏⊏I⊐⊐⊐ for 100,000, I⊐⊐⊐⊐ for 500,000 and ⊏⊏⊏⊏I⊐⊐⊐⊐ for one million.

That the Romans did not originally write M for 1000, and C for 100, but square characters, as they are written above, we are expressly informed by Paulus Manutius; but the corners of the angles being cut off by the transcribers for despatch, these figures were gradually brought into what are now numeral letters.—When the corners of ⊏I⊐ were made round, it stood thus CIↃ, which is so near the Gothic *m*, that it soon deviated into that letter; so I⊐ having the corner made round, it stood thus IↃ, and then easily deviated into D. ⊏ also became a plain C by the same means; the single rectangle which denoted 50, was without alteration, a capital L; the double acute angle was an X; the single acute angle a V consonant; and a plain single stroke, the letter I; and thus these seven letters, M, D, C, L, X, V, I, became numerals.

Numeral *Characters* of the Arabs, are those figures which are now used in all the operations of arithmetic in every nation in Europe. We have elsewhere shown that the Arabs derived the use of them most probably from

from India, (See Arithmetic, N° 5.). This opinion, however, though very generally received, has been controverted with some ingenuity. A writer in the Gentleman's Magazine, at a period when that miscellany was in its highest reputation, thus endeavours to prove that the Arabs derived their notations from the Greeks. "I maintain (says he) that the Indians received their numeral characters from the Arabians, and the Arabians from the Greeks, as from them they derived all their learning, which in some things they improved, but for the most part have altered. The numerical figures which they received from the Greeks are proofs of this alteration; which is so great, that without particular attention one can scarce discover in them the vestiges of their origin. But when we compare them carefully and without prejudice, we find in them manifest traces of the Greek figures. The Greek numerical figures were no other than the letters of their alphabet. A small stroke was the mark of unity. The B, being abridged of its two extremities, produced the 2. If you incline the γ a little on its left side, and cut off its foot, and make the left horn round towards the left side, you will produce a 3; the Δ makes the 4, by raising the right leg perpendicularly, and lengthening it a little below the base, and lengthening the base on the left side. The ε forms the 5, by turning the lowest semicircle towards the right, which before was turned towards the left side. The number 5 forms the 6, by having its head taken off, and its body rounded. Z, by taking away the base, makes the 7. If we make the top and bottom of H round, we shall form an 8. The θ is the 9 with a very little alteration. The cypher o was only a point, to which one of the figures was added to make it stand for ten times as much. It was necessary to mark this point very strongly; and in order to form it better, a circle was made, which was filled up in the middle; but that circumstance was afterwards neglected. Theophanes, an historian of Constantinople, who lived in the ninth century, says expressly, that the Arabians retained the Greek figures, having no characters in their language to represent all the numbers. The Greeks observed in their numbers the decuple progression, which the Arabians have retained. Certain characters are found in the Greek alphabet, which are not used in reading, but only in calculation, and for this reason, they are styled *Episemes*, that is to say, *notes, marks*, in order to distinguish them from letters. The number 6 derives its form from one of these episemes, which was called επισημον βαυ. This episeme forms the letter F among the Æolians and among the Latins. This was called the *Digamma*, so styled from its figure, which seems to have been one Γ placed upon another.

That this reasoning is plausible will hardly be questioned; but whether it be conclusive our readers must determine. It has not convinced ourselves; but through the whole of this work we wish to state candidly the different opinions held on every subject of curiosity and usefulness.

NUMERATION, or Notation, in *Arithmetic*, the art of expressing in characters any number proposed in words, or of expressing in words any number proposed in characters. See Arithmetic, N° 7.

NUMERICAL, Numerous, or *Numeral*, something belonging to numbers; as numerical algebra is that which makes use of numbers, instead of letters of the alphabet.—Also numerical difference is that by which one man is distinguished from another. Hence a thing is said to be numerically the same, when it is so in the strictest sense of the word.

NUMIDA, a genus of birds belonging to the order of gallinæ. See Ornithology *Index*.

NUMIDIA, an ancient kingdom of Africa, bounded on the north by the Mediterranean sea; on the south by Gætulia, or part of Libya Interior; on the west by the Mulucha, a river which separated it from Mauritania; and on the east by the Tusca, another river which bounded it in common with Africa Propria. Dr Shaw has rendered it probable, that the river which formerly went under the denominations of *Malva, Malvana, Mulucha*, and *Molochath*, is the same with that now called Mullooiah by the Algerines; in which case, the kingdom of Numidia must have extended upwards of 500 miles in length: its breadth, however, cannot be so well ascertained; but supposing it to have been the same with that of the present kingdom of Algiers, in the narrowest part it must have been at least 40 miles broad, and in the widest upwards of 100.

1 Ancient division.

This country included two districts; one inhabited by the *Massyli*, and the other by the *Massæsyli;* the latter being also called in after times, *Mauritania Cæsariensis*, and the former *Numidia Propria*. The country of the Massyli, or, as some call it, *Terra Metagonitis*, was separated from the proper territory of Carthage by its eastern boundary the river Tusca, and from the kingdom of the Massylia, or Mauritania Cæsariensis, by the river Ampsaga. It seems to correspond with that part of the province of Constantina lying between the Zaine and the Wed al Kibeer, which is above 130 miles long, and more than 100 broad. The sea coast of this province is for the most part mountainous and rocky, answering to the appellation given to it by Abulfeda, viz. *El Edwaa, the high or lofty*. It is far from being equal in extent to the ancient country of the Massæsyli, which, Strabo informs us, was yet inferior to the country of the Massyli. Its capital was Cirta, a place of very considerable note among the ancients.

2 Peopled by the descendants of Phut.

The most celebrated antiquarians agree, that the tract, extending from the isthmus of Suez to the lake Tritonis, was chiefly peopled by the descendants of Mizraim, and that the posterity of his brother Put, or Phut, spread themselves all over the country between that lake and the Atlantic ocean. To this notion Herodotus gives great countenance: for he tells us, that the Libyan Nomades, whose territories to the west were bounded by the Triton, agreed in their customs and manners with the Egyptians; but that the Africans, from that river to the Atlantic ocean, differed in almost all points from them. Ptolemy mentions a city called *Putea* near Adrametum; and Pliny, a river of Mauritania Tingitana, known by the name of *Fut*, or *Phut;* and the district adjacent to this river was called *Regio Phutensis*, which plainly alludes to the name of *Phut*. That word signifies *scattered*, or *dispersed*, which very well agrees with what Mela and Strabo relate of the ancient Numidians; so that we may, without any scruple, admit the aborigines of this country to have been the descendants of Phut.

3 Great part of the history unknown.

The history of Numidia, during many of the early ages, is buried in oblivion. It is probable, however, that as the Phœnicians were masters of a great part of the

Numidia. the country, these transactions had been recorded, and generally known to the Carthaginians. King Jarbas probably reigned here as well as in Africa Propria, if not in Mauritania, and other parts of Libya, when Dido began to build Byrsa. It appears from Justin, that about the age of Herodotus, the people of this country were called both *Africans* or *Libyans* and *Numidians*. Justin likewise intimates, that about this time the Carthaginians vanquished both the Moors or Mauritanians and the Numidians; in consequence of which they were excused from paying the tribute which had hitherto been demanded of them.

After the conclusion of the first Punic war, the African troops carried on a bloody contest against their masters the Carthaginians; and the most active in this rebellion, according to Diodorus Siculus, were a part of the Numidian nation named *Micatanians*. This so incensed the Carthaginians, that after Hamilcar had either killed or taken prisoners all the mercenaries, he sent a large detachment to ravage the country of those Numidians. The commandant of that detachment executed his orders with the utmost cruelty, plundering the district in a terrible manner, and crucifying all the prisoners without distinction that fell into his hands. This filled the rest with such indignation and resentment, that both they and their posterity ever afterwards bore an implacable hatred to the Carthaginians.

4
History of Syphax and Masinissa.

In the time of the second Punic war, Syphax king of the Massæsyli entered into an alliance with the Romans, and gave the Carthaginians a considerable defeat. This induced Gala, king of the Massyli, to conclude a treaty with the Carthaginians, in consequence of which his son Masinissa marched at the head of a powerful army to give Syphax battle. The contest ended in favour of Masinissa; 30,000 of the Massæsyli were put to the sword, and Syphax driven into Mauritania; and the like bad success attended Syphax in another engagement, where his troops were entirely defeated and dispersed.

Gala dying whilst his son Masinissa was acting at the head of the Numidian troops sent to the assistance of the Carthaginians in Spain, his brother Desalces, according to the established rules of succession in Numidia, took possession of the Massylian throne. That prince dying soon after his succession, Capusa his eldest son succeeded him. But he did not long enjoy his high dignity; for one Mezetulus, a person of the royal blood, but an enemy to the family of Gala, found means to excite a great part of his subjects to revolt. A battle soon took place between him and Capusa; in which the latter was slain with many of the nobility, and his army entirely defeated. But though Mezetulus thus became possessed of the sovereignty, he did not think proper to assume the title of *king*, but styled himself guardian to Lacumaces, the surviving son of Desalces, whom he graced with the royal title. To support himself in his usurpation, he married the dowager of Desalces, who was Hannibal's niece, and consequently of the most powerful family in Carthage. In order to attain the same end, he sent ambassadors to Syphax, to conclude a treaty of alliance with him. In the mean time Masinissa, receiving advice of his uncle's death, of his cousin's slaughter, and of Mezetulus's usurpation, immediately passed over to Africa, and went to the court of Bocchar king of Mauritania to solicit succours. Bocchar, sensible of the great injustice done Masinissa, gave him a body of 4000 Moors to escort him to his dominions. His subjects, having been apprised of his approach, joined him upon the frontiers with a party of 500 men. The Moors in pursuance of their orders, returned home, as soon as Masinissa reached the confines of his kingdom. Notwithstanding which, and the small body that declared for him having accidentally met Lacumaces at Thapsus with an escort going to implore Syphax's assistance, he drove him into the town, which he carried by assault after a faint resistance. However, Lacumaces, with many of his men, found means to escape to Syphax. The fame of this exploit gained Masinissa great credit, insomuch that the Numidians flocked to him from all parts. and amongst the rest, many of his father Gala's veterans, who pressed him to make a speedy and vigorous push for his hereditary dominions. Lacumaces having joined Mezetulus with a reinforcement of Massæsylians, which he had prevailed upon Syphax to send to the assistance of his ally, the usurper advanced at the head of a numerous army to offer Masinissa battle; which that prince, though much inferior in numbers, did not decline. Hereupon an engagement ensued; which notwithstanding the inequality of numbers ended in the defeat of Lacumaces. The immediate consequence of this victory of Masinissa was a quiet and peaceable possession of his kingdom; Mezetulus and Lacumaces, with a few that attended them, flying into the territories of Carthage. However, being apprehensive that he should be obliged to sustain a war against Syphax, he offered to treat Lacumaces with as many marks of distinction as his father Gala had Desalces, provided that prince would put himself under his protection. He also promised Mezetulus pardon, and a restitution of all the effects forfeited by his treasonable conduct, if he would make his submission to him. Both of them readily complied with the proposal, and immediately returned home; so that the tranquillity and repose of Numidia would have been settled upon a solid and lasting foundation, had not this been prevented by Asdrubal, who was then at Syphax's court. He insinuated to that prince, who was disposed to live amicably with his neighbours, "That he was greatly mistaken, if he imagined Masinissa would be satisfied with his hereditary dominions. That he was a prince of much greater capacity and ambition, than either his father Gala, his uncle Desalces, or any of his family. That he had discovered in Spain marks of a most rare and uncommon merit. And that, in fine, unless his rising flame was extinguished before it came to too great a head, both the Massæsylian and Carthaginian states would be infallibly consumed by it." Syphax, alarmed by these suggestions, advanced with a numerous body of forces into a district which had long been in dispute between him and Gala, but was then in possession of Masinissa. This brought on a general action between these two princes; wherein the latter was totally defeated, his army dispersed, and he himself obliged to fly to the top of Mount Balbus, attended only by a few of his horse. Such a decisive battle at the present juncture, before Masinissa was fixed in his throne, could not but put Syphax into possession of the kingdom of the Massyli. Masinissa in the mean time made nocturnal incursions from his post upon Mount Balbus, and plundered all the adjacent country, particularly that part of the Carthaginian teritory contiguous to Numidia. This district he not only thoroughly pillaged, but likewise laid waste with fire and sword, carrying off from thence

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Numidia. an immense booty, which was bought by some merchants, who had put into one of the Carthaginian ports for that purpose. In fine, he did the Carthaginians more damage, not only by committing such dreadful devastations, but by massacring and carrying into captivity vast numbers of their subjects on this occasion, than they could have sustained in a pitched battle, or one campaign of a regular war. Syphax, at the pressing and reiterated instances of the Carthaginians, sent Bocchar, one of his most active commanders, with a detachment of 4000 foot, and 2000 horse, to reduce this pestilent gang of robbers, promising him a great reward if he could bring Masinissa either alive or dead. Bocchar, watching an opportunity, surprised the Massylians, as they were straggling about the country without any order or discipline; so that he took many prisoners, dispersed the rest, and pursued Masinissa himself, with a few of his men, to the top of the mountain where he had before taken post. Considering the expedition as ended, he not only sent many head of cattle, and the other booty that had fallen into his hands, to Syphax, but likewise all the force, except 500 foot and 200 horse. With this detachment he drove Masinissa from the summit of the hill, and pursued him through several narrow passes and defiles, as far as the plains of Clupea. Here he so surrounded him, that all the Massylians, except four, were put to the sword, and Masinissa himself, after having received a dangerous wound, escaped with the utmost difficulty. As this was effected by crossing a rapid river, in which attempt two of his four attendants perished in the sight of the detachment that pursued him, it was rumoured all over Africa, that Masinissa also was drowned; which gave inexpressible pleasure to Syphax and the Carthaginians. For some time he lived undiscovered in a cave, where he was supported by the robberies of the two horsemen that had made their escape with him. But having cured his wound by the application of some medicinal herbs, he boldly began to advance towards his own frontiers, giving out publicly that he intended once more to take possession of his kingdom. In his march he was joined by about 40 horse, and, soon after his arrival amongst the Massyli, so many people flocked to him from all parts, that out of them he formed an army of 6000 foot and 4000 horse. With these forces, he not only reinstated himself in the possession of his dominions, but likewise laid waste the borders of the Massæsyli. This so irritated Syphax, that he immediately assembled a body of troops, and encamped very commodiously upon a ridge of mountains between Cirta and Hippo. His army he commanded in person; and detached his son Vermina, with a considerable force, to take a compass, and attack the enemy in the rear. In pursuance of his orders, Vermina set out in the beginning of the night, and took post in the place appointed him, without being discovered by the enemy. In the mean time Syphax decamped, and advanced towards the Massyli, in order to give them battle. When he had possessed himself of a rising ground that led to their camp, and concluded that his son Vermina must have formed the ambuscade behind them, he began the fight. Masinissa being advantageously posted, and his soldiers distinguishing themselves in an extraordinary manner, the dispute was long and bloody. But Vermina unexpectedly falling upon their rear, and by this means obliging them to divide their forces, which were scarcely able before to oppose the main body under Syphax, they were soon thrown into confusion, and forced to betake themselves to a precipitate flight. All the avenues being blocked up, partly by Syphax, and partly by his son, such a dreadful slaughter was made of the unhappy Massyli, that only Masinissa himself, with 60 horse, escaped to the Lesser Syrtis. Here he remained, betwixt the confines of the Carthaginians and the Garamantes, till the arrival of Lælius and the Roman fleet on the coast of Africa. What happened immediately after this junction with the Romans, belongs to the article ROME.

It will be sufficient, therefore, in this place to observe, that, by the assistance of Lælius, Masinissa at last reduced Syphax's kingdom. According to Zonaras, Masinissa and Scipio, before the memorable battle of Zama, by a stratagem, deprived Hannibal of some advantageous posts; which, with a solar eclipse happening during the heat of the action, and not a little intimidating the Carthaginian troops, greatly contributed to the victory the Romans obtained. At the conclusion therefore of the second Punic war, he was amply rewarded by the Romans for the important services he had done them. As for Syphax, after the loss of his dominions, he was kept in confinement for some time at Alba; from whence being removed in order to grace Scipio's triumph, he died at Tibur in his way to Rome. Zonaras adds, that his corpse was decently interred; that all the Numidian prisoners were released; and that Vermina, by the assistance of the Romans, took peaceable possession of his father's throne. However, part of the Massæsylian kingdom had been before annexed to Masinissa's dominions, in order to reward that prince for his singular fidelity and close attachment to the Romans.

This seems to be countenanced by the epitomizer of Livy, who gives us sufficiently to understand, that Syphax's family, for a considerable time after the conclusion of the second Punic war, reigned in one part of Numidia. For he intimates, that Archobarzanes, Syphax's grandson, and probably Vermina's son, hovered with a powerful army of Numidians upon the Carthaginian frontiers a few years before the beginning of the third Punic war. This he seems to have done, either in order to cover them, or to enable the Carthaginians to make an irruption into Masinissa's territories. Cato, however, pretended that these forces, in conjunction with those of Carthage, had a design to invade the Roman dominions, which he urged as a reason to induce the conscript fathers to destroy the African republic.

Nothing further is requisite, in order to complete the history of this famous prince, than to exhibit to our readers view some points of his conduct towards the decline, and at the close, of life; the wise dispositions made after his death by Æmilianus, in order to the regulation of his domestic affairs; and some particulars relating to his character, genius, and habit of body, drawn from the most celebrated Greek and Roman authors.

By drawing a line of circumvallation around the Carthaginian army under Asdrubal, posted upon an eminence, Masinissa cut off all manner of supplies from them; which introduced both the plague and famine into their camp. As the body of Numidian troops employed

Numidia. ployed in this blockade was not near so numerous as the Carthaginian forces, it is evident, that the line here mentioned must have been extremely strong, and consequently the effect of great labour and art. The Carthaginians, finding themselves reduced to the last extremity, concluded a peace upon the following terms, which Masinissa dictated to them: 1. That they should deliver up all deserters. 2. That they should recal their exiles, who had taken refuge in his dominions. 3. That they should pay him 5000 talents of silver within the space of 50 years. 4. That their soldiers should pass under the jugum, each of them carrying off only a single garment. As Masinissa himself, though between 80 and 90 years of age, conducted the whole enterprise, he must have been extremely well versed in fortification, and other branches of the military art. His understanding likewise he must have retained to the last. This happened a short time before the beginning of the third Punic war. See CARTHAGE.

5
Masinissa displeased with the Romans;

Soon after, the consuls landed an army in Africa, in order to lay siege to Carthage, without imparting to Masinissa their design. This not a little chagrined him, as it was contrary to the former practice of the Romans; who, in the preceding war, had communicated their intentions to him, and consulted him on all occasions. When, therefore, the consuls applied to him for a body of his troops to act in concert with their forces, he made answer, "That they should have a reinforcement from him when they stood in need of it." It could not but be provoking to him to consider, that after he had extremely weakened the Carthaginians, and even brought them to the brink of ruin, his pretended imperious friends should come to reap the fruits of his victory, without giving him the least intelligence of it.

However, his mind soon returned to its natural bias, which was in favour of the Romans. Finding his end approaching, he sent to Æmilianus, then a tribune in the Roman army, to desire a visit from him. What he proposed by this visit, was to invest him with full powers to dispose of his kingdom and estate as he should think proper, for the benefit of his children. The high idea he had entertained of that young hero's abilities and integrity, together with his gratitude and affection for the family into which he was adopted, induced him to take this step. But, believing that death would not permit him to have a personal conference with Æmilianus upon this subject, he informed his wife and children in his last moments, that he had empowered him to dispose in an absolute manner of all his possessions, and divide his kingdom amongst his sons. To which he subjoined, "I require, that whatever Æmilianus may decree, shall be executed as punctually as if I myself had appointed it by my will." Having uttered these words, he expired, at about 90 years of age.

6
but leaves every thing to the disposal of Æmilianus.

This prince, during his youth, had met with strange reverses of fortune. However, says Appian, being supported by the Divine protection, he enjoyed an uninterrupted course of prosperity for a long series of years. His kingdom extended from Mauritania to the western confines of Cyrenaica; from whence it appears, that he was one of the most powerful princes of Africa. Many of the inhabitants of this vast tract he civilized in a wonderful manner, teaching them to cultivate their soil, and to reap those natural advantages which the fertility of some parts of their country offered them. He was of a more robust habit of body than any of his cotemporaries, being blessed with the greatest health and vigour; which was doubtless owing to his extreme temperance, and the toils he incessantly sustained. We are informed by Polybius, that sometimes he stood upon the same spot of ground from morning till evening, without the least motion, and at others continued as long in a sitting posture. He would remain on horseback for several days and nights together, without being sensible of the least fatigue. Nothing can better evince the strength of his constitution, than his youngest son, named *Stembal*, *Sthembo*, or *Stembonus*, who was but four years old at his decease. Though 90 years of age, he performed all the exercises used by young men, and always rode without a saddle. Pliny tells us, that he reigned above 60 years. He was an able commander, and much facilitated the reduction of Carthage. Plutarch from Polybius observes, that the day after a great victory won over the Carthaginians, Masinissa was seen sitting at the door of his tent, eating a piece of brown bread. Suidas relates, that to the last he could mount his horse without any assistance. According to Appian he left a numerous well disciplined army, and an immense quantity of wealth, behind him.

Masinissa, before his death, gave his ring to his eldest son Micipsa; but left the distribution of all his other effects and possessions amongst his children entirely to Æmilianus. Of 54 sons that survived him, only three were legitimate, to wit, Micipsa, Gulussa, and Mastanabal. Æmilianus arrived at Cirta after he had expired, divided his kingdom, or rather the government of it, amongst these three, though to the others he gave considerable possessions. To Micipsa, who was a prince of a pacific disposition, and the eldest son, he assigned Cirta, the metropolis, for the place of his residence, in exclusion of the others. Gulussa, the next to him, being a prince of military genius, had the command of the army, and the transacting of all affairs relating to peace or war committed to his care. And Mastanabal, the youngest, had the administration of justice, an employment suitable to his education, allotted him. They enjoyed in common the immense treasures Masinissa had amassed, and were all of them dignified by Æmilianus with the royal title. After he had made these wise dispositions, that young nobleman departed from Cirta, taking with him a body of Numidian troops, under the conduct of Gulussa, to reinforce the Roman army that was then acting against the Carthaginians.

Mastanabal and Gulussa died soon after their father, as appears from the express testimony of Sallust. We find nothing more remarkable of these princes, besides what has been already related, than that the latter continued to assist the Romans in the third Punic war, and that the former was pretty well versed in the Greek language. Micipsa therefore became sole possessor of the kingdom of Numidia. In his reign, and under the consulate of M. Platius Hypsæus and M. Fulvius Flaccus, according to Orosius, a great part of Africa was covered with locusts, which destroyed all the produce of the earth, and even devoured dry wood. But at last they were all carried by the wind into the African sea, out of which being thrown in vast heaps upon the shore, a plague ensued which swept away an infinite

Numidia. number of animals of all kinds. In Numidia only 800,000 men perished, and in Africa Propria 200,000; amongst the rest, 30,000 Roman soldiers quartered in and about Utica for the defence of the latter province. At Utica, in particular, the mortality raged to such a degree, that 1500 dead bodies were carried out of one gate in a day. Micipsa had two sons, Adherbal and Hiempsal, whom he educated in his palace, together with his nephew Jugurtha. That young prince was the son of Mastanabal; but his mother having been only a concubine, Masinissa had taken no great notice of him. However, Micipsa considering him as a prince of the blood, took as much care of him as he did of his own children.

7 History of Jugurtha.

Jugurtha possessed several eminent qualities, which gained him universal esteem. He was very handsome, endued with great strength of body, and adorned with the finest intellectual endowments. He did not devote himself, as young men commonly do, to a life of luxury and pleasure. He used to exercise himself, with persons of his age, in running, riding, hurling the javelin, and other manly exercises, suited to the martial genius of the Numidians; and though he surpassed all his fellow sportsmen, there was not one of them but loved him. The chase was his only delight; but it was that of lions and other savage beasts. Sallust, to finish his character, tells us, that he excelled in all things, and spoke very little of himself.

So conspicuous an assemblage of fine talents and perfections, at first charmed Micipsa, who thought them an ornament to his kingdom. However, he soon began to reflect, that he was considerably advanced in years, and his children in their infancy; that mankind naturally thirsted after power, and that nothing was capable of making men run greater lengths than a vicious and unlimited ambition. These reflections soon excited his jealousy, and determined him to expose Jugurtha to a variety of dangers, some of which, he entertained hopes, might prove fatal to him. In order to this, he gave him the command of a body of forces which he sent to assist the Romans, who were at that time besieging Numantia in Spain. But Jugurtha, by his admirable conduct, not only escaped all those dangers, but likewise won the esteem of the whole army, and the friendship of Scipio, who sent a high character of him to his uncle Micipsa. However, that general gave him some prudent advice in relation to his future conduct; observing, no doubt, in him certain sparks of ambition, which, if lighted into a flame, he apprehended might one day be productive of the most fatal consequences.

8 Is dreaded by King Micipsa,

Before this last expedition, Micipsa had endeavoured to find out some method of taking him off privately; but his popularity amongst the Numidians obliged that prince to lay aside all thoughts of this nature. After his return from Spain the whole nation almost adored him. The heroic bravery he had shown there, his undaunted courage, joined to the utmost calmness of mind, which enabled him to preserve a just medium between a timorous foresight and an impetuous rashness, a circumstance rarely to be met with in persons of his age, and above all the advantageous testimonials of his conduct given by Scipio, attracted an universal esteem. Nay, Micipsa himself, charmed with the high opinion the Roman general had entertained of his merit, changed his behaviour towards him; resolving, if possible, to win his affection by kindness. He therefore adopted him, and declared him joint heir with his two sons to the crown. Finding, some few years afterwards, that his end approached, he sent for all three to his bed side; where, in the presence of the whole court, he desired Jugurtha to recollect with what extreme tenderness he had treated him, and consequently to consider how well he had deserved at his hands.

9 who nevertheless entrusts him with the care of his children;

He then entreated him to protect his children on all occasions; who, being before related to him by the ties of blood, were now by their father's bounty become his brethren. In order to fix him the more firmly in their interest, he likewise complimented him upon his bravery, address, and consummate prudence. He further insinuated, that neither arms nor treasures constitute the strength of a kingdom; but friends, who are neither won by arms nor gold, but by real services and an inviolable fidelity. "Now, where (continued he) can we find better friends than in brothers? And how can that man who becomes an enemy to his relations, repose any confidence in, or depend upon strangers?" Then addressing himself to Adherbal and Hiempsal, "And you (said he) I enjoin always to pay the highest reverence to Jugurtha. Endeavour to imitate, and if possible surpass, his exalted merit, that the world may not hereafter observe Micipsa's adopted son to have reflected greater glory upon his memory than his own children." Soon after, Micipsa, who, according to Diodorus, was a prince of an amiable character, expired. Though Jugurtha did not believe the king to speak his real sentiments with regard to him, yet he seemed extremely pleased with so gracious a speech, and made him an answer suitable to the occasion. However, that prince at the same time was determined within himself to put in execution the scheme he had formed at the siege of Numantia, which was suggested to him by some factious and abandoned Roman officers, with whom he there contracted an acquaintance. The purport of this scheme was, that he should extort the crown by force from his two cousins, as soon as their father's eyes were closed; which they insinuated might easily be effected by his own valour, and the venality of the Romans. Accordingly, a short time after the old king's death, he found means to assassinate Hiempsal in the city of Thirmida where his treasures were deposited, and drive Adherbal out of his dominions That unhappy prince found himself obliged to fly to Rome, where he endeavoured to engage the conscript fathers to espouse his quarrel; but, notwithstanding the justice of his cause, they had not virtue enough effectually to support him. Jugurtha's ambassadors, by distributing vast sums of money amongst the senators, brought them so far over, that a majority palliated his inhuman proceedings. This encouraged those ministers to declare, that Hiempsal had been killed by the Numidians on account of his excessive cruelty; that Adherbal was the aggressor in the late troubles; and that he was only chagrined because he could not make that havock among his countrymen he would willingly have done. They therefore entreated the senate to form a judgment of Jugurtha's behaviour in Africa from his conduct at Numantia, rather than from the suggestions of his enemies. Upon which, by far the greatest part of the senate discovered themselves prejudiced

10 one of whom he murders, and drives out the other.

Numidia. prejudiced in his favour. A few, however, that were not lost to honour, nor abandoned to corruption, insisted upon bringing him to condign punishment. But as they could not prevail, he had the best part of Numidia allotted him, and Adherbal was forced to rest satisfied with the other.

11 Venality of the Romans. Jugurtha finding now by experience that every thing was venal at Rome, as his friends at Numantia had before informed him, thought he might pursue his towering projects without any obstruction from that quarter. He therefore, immediately after the last division of Micipsa's dominions, threw off the mask, and attacked his cousin by open force. As Adherbal was a prince of a pacific disposition, and almost in all respects the reverse of Jugurtha, he was by no means a match for him. The latter therefore pillaged the former's territories, stormed several of his fortresses, and overran a good part of his kingdom without opposition. Adherbal, depending on the friendship of the Romans, which his father in his last moments assured him would be a stronger support to him than all the troops and treasures in the universe, despatched deputies to Rome to complain of these hostilities. But whilst he lost his time in sending thither fruitless deputations, Jugurtha overthrew him in a pitched battle, and soon after shut him up in Cirta. During the siege of this city, a Roman commission arrived there, in order to persuade both parties to an accommodation; but finding Jugurtha untractable, the commissioners returned home without so much as conferring with Adherbal. A second deputation, composed of senators of the highest distinction, with Æmilius Scaurus, president of the senate, at their head, landed some time after at Utica, and summoned Jugurtha to appear before them. That prince at first seemed to be under dreadful apprehensions, especially as Scaurus reproached him with his enormous crimes, and threatened him with the resentment of the Romans if he did not immediately raise the siege of Cirta. However, the Numidian, by his address, and the irresistible power of gold, as was afterwards suspected at Rome, so mollified Scaurus, that he left Adherbal at his mercy. In fine, Jugurtha had at last Cirta surrendered to him, upon condition only that he should spare the life of Adherbal. But the merciless tyrant, in violation of the laws of nature and humanity as well as the capitulation, when he had got possession of the town, ordered him to be put to a most cruel death. The merchants likewise, and all the Numidians in the place capable of bearing arms, he caused without distinction to be put to the sword.

Every person at Rome inspired with any sentiments of humanity, was struck with horror at the news of this tragical event. However, all the venal senators still concurred with Jugurtha's ministers in palliating his enormous crimes. Notwithstanding which, the people, excited thereto by Caius Memmius their tribune, who bitterly inveighed against the venality of the senate, resolved not to let so flagrant an instance of villany go unpunished. This disposition in them induced the conscript fathers likewise to declare their intention to chastise Jugurtha. In order to this, an army was levied to invade Numidia, and the command of it given to the consul Calpurnius Bestia, a person of good abilities, but rendered unfit for the expedition he was to go upon by his insatiable avarice. Jugurtha being informed of the great preparations making at Rome to attack his dominions, sent his son thither to avert the impending storm. The young prince was plentifully supplied with money, which he had orders to distribute liberally amongst the leading men. But Bestia, proposing to himself great advantages from an invasion of Numidia, defeated all his intrigues, and got a decree passed, ordering him and his attendants to depart Italy in ten days, unless they were come to deliver up the king himself, and all his territories, to the republic by way of dedition. Which decree being notified to them, they returned without so much as having entered the gates of Rome; and the consul soon after landed with a powerful army in Africa. For some time he carried on the war there very briskly, reduced several strong holds, and took many Numidians prisoners. But upon the arrival of Scaurus, a peace was granted Jugurtha upon advantageous terms. That prince coming from Vacca, the place of his residence, to the Roman camp, in order to confer with Bestia and Scaurus, and the preliminaries of the treaty being immediately after settled between them in private conferences, everybody at Rome was convinced that the prince of the senate and the consul had to their avarice sacrificed the republic. The indignation therefore of the people in general displayed itself in the strongest manner. Memmius also fired them with his speeches. It was therefore resolved to despath the prætor Cassius, a person they could confide in, to Numidia, to prevail upon Jugurtha to come to Rome, that they might learn from the king himself which of their generals and senators had been seduced by the pestilent influence of corruption. Upon his arrival there, he found means to bribe one Bæbius Salca, a man of great authority amongst the plebeians, but of insatiable avarice, by whose assistance he escaped with impunity. Nay, by the efficacy of gold, he not only eluded all the endeavours of the people of Rome to bring him to justice, but likewise enabled Bomilcar, one of his attendants, to get Massiva, an illegitimate son of Micipsa, assassinated in the streets of Rome. That young prince was advised by many Romans of probity, wellwishers to the family of Masinissa, to apply for the kingdom of Numidia; which coming to Jugurtha's ears, he prevented the application by this execrable step. However, he was obliged to leave Italy immediately.

Jugurtha had scarce set foot in Africa, when he received advice that the senate had annulled the shameful peace concluded with him by Bestia and Scaurus. Soon after, the consul Albinus transported a Roman army into Numidia, flattering himself with the hopes of reducing Jugurtha to reason before the expiration of his consulate. In this, however, he found himself deceived; for that crafty prince, by various artifices so amused and imposed upon Albinus, that nothing of moment happened that campaign. This rendered him strongly suspected of having betrayed his country, after the example of his predecessors. His brother Aulus, who succeeded him in the command of the army, was still more unsuccessful; for after rising from before Suthul, where the king's treasures were deposited, he marched his forces into a defile, out of which he found it impossible to extricate himself. He therefore was obliged to submit to the ignominious ceremony of passing under the *jugum*, with all his men, and to quit Numidia entirely in ten days time, Numidia. time, in order to deliver his troops from immediate destruction. The avaricious disposition of the Roman commander had prompted him to besiege Suthul, the possession of which place he imagined would make him master of all the wealth of Jugurtha, and consequently paved the way to such a scandalous treaty. However, this was declared void as soon as known at Rome, as being concluded without the authority of the people. The Roman troops retired into Africa Propria, which they had now reduced into the form of a Roman province, and there took up their winter quarters.

In the mean time Caius Mamillius Limetanus, tribune of the people, excited the plebeians to inquire into the conduct of those persons by whose assistance Jugurtha had found means to elude all the decrees of the senate. This put the body of the people into a great ferment; which occasioned a prosecution of the guilty senators, that was carried on, for some time, with the utmost heat and violence. Lucius Metellus
12 Metellus sent against Jugurtha. the consul, during these transactions, had Numidia assigned him for his province, and consequently was appointed general of the army destined to act against Jugurtha. As he perfectly disregarded wealth, the Numidian found him superior to all his temptations; which was a great mortification to him. To this he joined all the other virtues which constitute the great captain; so that Jugurtha found him in all respects inaccessible. That prince therefore was now forced to regulate his conduct according to the motions of Metellus, with the greatest caution; and to exert his utmost bravery, in order to compensate for that hitherto so favourable expedient which now began to fail him. Marius, Metellus's lieutenant, being likewise a person of uncommon merit, the Romans reduced Vacca, a large opulent city, and the most celebrated mart in Numidia. They also defeated Jugurtha in a pitched battle; overthrew Bomilcar, one of his generals, upon the banks of the Muthullus; and, in fine, forced the Numidian monarch to take shelter in a place rendered almost inaccessible by the rocks and woods with which it was covered. However, Jugurtha signalized himself in a surprising manner, exhibiting all that could be expected from the courage, abilities, and attention of a consummate general, to whom despair administers fresh strength, and suggests new lights. But his troops could not make head against the Romans; they were again worsted by Marius, though they obliged Metellus to raise the siege of Zama. Jugurtha, therefore, finding his country everywhere ravaged, his most opulent cities plundered, his fortresses reduced, his towns burnt, vast numbers of his subjects put to the sword and taken prisoners, began to think seriously of coming
13 Who is betrayed by Bomilcar. to an accommodation with the Romans. His favourite Bomilcar, in whom he reposed the highest confidence, but who had been gained over to the enemy by Metellus, observing this disposition, found it no difficult matter to persuade him to deliver up his elephants, money, arms, horses, and deserters, in whom the main strength of his army consisted, into the hands of the Romans. Some of these last, in order to avoid the punishment due to their crime, retired to Bocchus king of Mauritania, and listed in his service. But Metellus ordering him to repair to Tisidium, a city of Numidia, there to receive farther directions, and he refusing a compliance with that order, hostilities were renewed with greater fury than ever. Fortune now seemed to declare in favour of Jugurtha: he retook Vacca, and massacred all the Roman garrison, except Turpilius the commandant. However, soon after, a Roman legion seized again upon it, and treated the inhabitants with the utmost severity. About this time, one of Mastanabal's sons, named *Gauda*, whom Micipsa in his will had appointed to succeed to the crown in case his two legitimate sons and Jugurtha died without issue, wrote to the senate in favour of Marius, who was then endeavouring to supplant Metellus. That prince having his understanding impaired by a declining state of health, fell a more easy prey to the base and infamous adulation of Marius. The Roman, soothing his vanity, assured him, that as he was the next heir to the crown, he might depend upon being fixed upon the Numidian throne, as soon as Jugurtha was either killed or taken; and that this must in a short time happen, when once he appeared at the head of the Roman army with an unlimited commission. Soon after, Bomilcar and Nabdalsa formed a design to assassinate Jugurtha, at the instigation of Metellus; but this being detected, Bomilcar and most of his accomplices suffered death. The plot however had such an effect upon Jugurtha, that he enjoyed afterwards no tranquillity or repose. He suspected persons of all denominations, Numidians as well as foreigners, of some black designs against him. Perpetual terrors sat brooding over his mind; insomuch that he never got a wink of sleep but by stealth, and often changed his bed in a low plebeian manner. Starting from his sleep, he would frequently snatch his sword, and break out into the most doleful cries: So strongly was he haunted by a spirit of fear, jealousy, and distraction! 14 A conspiracy against him.

Jugurtha having destroyed great numbers of his friends on suspicion of their having been concerned in the late conspiracy, and many more of them deserting to the Romans and Bocchus king of Mauritania, he found himself, in a manner, destitute of counsellors, generals, and all persons capable of assisting him in carrying on the war. This threw him into a deep melancholy, which rendered him dissatisfied with every thing, and made him fatigue his troops with a variety of contradictory motions. Sometimes he would advance with great celerity against the enemy, and at others retreat with no small swiftness from them. Then he resumed his former courage, but soon after despaired either of the valour or fidelity of the forces under his command. All his movements therefore proved unsuccessful, and at last he was forced by Metellus to a battle. That part of the Numidian army which Jugurtha commanded, behaved with some resolution; but the other fled at the first onset. The Romans therefore entirely defeated them, took all their standards, and made a few of them prisoners. But few of them were slain in the action; since, as Sallust observes, the Numidians trusted more to their heels than to their arms for safety in this engagement. 15 He is defeated by Metellus.

Metellus pursued Jugurtha and his fugitives to Thala. His march to this place being through vast deserts, was extremely tedious and difficult. But being supplied with leathern bottles and wooden vessels of all sizes taken from the hut of the Numidians, which were filled with water brought by the natives, who had submitted to him, he advanced towards the

city.

Numidia. city. He had no sooner begun his march, than a most copious shower of rain, a thing very uncommon in those deserts, proved a great and seasonable refreshment to his troops. This so animated them, that upon their arrival before Thala, they attacked the town with such vigour, that Jugurtha with his family, and treasures deposited therein, thought proper to abandon it. After a brave defence, it was reduced; the garrison, consisting of Roman deserters, setting fire to the king's palace, and consuming themselves, together with every thing valuable to them, in the flames. Jugurtha, being now reduced to great extremities, retired into Gætulia, where he formed a considerable corps. From thence he advanced to the confines of Mauritania; and engaged Bocchus king of that country, who had married his daughter, to enter into an alliance with him. In consequence of which, having reinforced his Gætulian troops with a powerful body of Mauritanians, he turned the tables upon Metellus, and obliged him to keep close within his entrenchments. Sallust informs us, that Jugurtha bribed Bocchus's ministers to influence that prince in his favour; and that having obtained an audience, he insinuated, that, should Numidia be subdued, Mauritania must be involved in its ruin, especially as the Romans seemed to have vowed the destruction of all the thrones in the universe. In support of what he advanced, he produced several instances very apposite to the point in view. However, the same author seems to intimate, that Bocchus was determined to assist Jugurtha against his enemies by the slight the Romans had formerly shown him. That prince, at the first breaking out of the war, had sent ambassadors to Rome, to propose an offensive and defensive alliance to the republic; which, though of the utmost consequence to it at the juncture, a few of the most venal and infamous senators, who were abandoned to corruption, prevented from taking effect. This undoubtedly wrought more powerfully upon Bocchus in favour of Jugurtha, than the relation he stood in to him: For both the Moors and Numidians adapted the number of their wives to their circumstances, so that some had 10, 20, &c. to their share; their kings therefore were unlimited in this particular, and of course all degrees of affinity resulting to them from marriage had little force. It is observable, that the posterity of those ancient nations have the same custom prevailing amongst them at this day.

16 Marius succeeds Metellus.

Such was the situation of affairs in Numidia, when Metellus received advice of the promotion of Marius to the consulate. But, notwithstanding this injurious treatment, he generously endeavoured to draw off Bocchus from Jugurtha, though this would facilitate the reduction of Numidia for his rival. To this end ambassadors were despatched to the Mauritanian court, who intimated to Bocchus, "That it would be highly imprudent to come to a rupture with the Romans without any cause at all; and that he had now a fine opportunity of concluding a most advantageous treaty with them, which was much preferable to a war. To which they added, that whatever dependence he might place upon his riches, he ought not to run the hazard of losing his dominions by embroiling himself with other states, when he could easily avoid this; that it was much easier to begin a war than to end it, which it was in the power of the victor alone to do; that, in fine, he would by no means consult the interest of his subjects if he followed the desperate fortunes of Jugurtha." To which Bocchus replied. "That for his part there was nothing he wished for more than peace; but that he could not help pitying the deplorable condition of Jugurtha; that if the Romans, therefore, would grant that unfortunate prince the same terms they had offered him, he would bring about an accommodation." Metellus let the Mauritanian monarch know, that it was not in his power to comply with what he desired. However, he took care to keep up a private negotiation with him till the new consul Marius's arrival. By this conduct he served two wise ends. First, He prevented Bocchus from coming to a general action with his troops; which was the very thing Jugurtha desired, as hoping that this, whatever the event might be, would render a reconciliation betwixt him and the Romans impracticable. Secondly, This inaction enabled him to discover something of the genius and disposition of the Moors; a nation of whom the Romans, till then, had scarcely formed any idea; which, he imagined, might be of no small service, either to himself or his successors, in the future prosecution of the war.

Jugurtha, being informed that Marius, with a numerous army, was landed at Utica, advised Bocchus to retire, with part of the troops, to some place of difficult access, whilst he himself took post upon another inaccessible spot with the remaining corps. By this measure, he hoped the Romans would be obliged to divide their forces, and consequently be more exposed to his efforts and attacks. He likewise imagined, that seeing no formidable body appear, they would believe the enemy in no condition to make head against them; which might occasion a relaxation of discipline, the usual attendant of a too great security, and consequently produce some good effect. However, he was disappointed in both these views. For Marius, far from suffering a relaxation of discipline to take place, trained up his troops, which consisted chiefly of new levies, in so perfect a manner, that they were soon equal in goodness to any consular army that ever appeared in the field. He also cut off great numbers of the Gætulian marauders, defeated many of Jugurtha's parties, and had like to have taken that prince himself near the city of Cirta. These advantages, though not of any great importance, intimidated Bocchus, who now made overtures for an accommodation; but the Romans, not being sufficiently satisfied of his sincerity, paid no great attention to them. In the mean time Marius pushed on his conquests, reducing several places of less note, and at last resolved to besiege Capsa. That this enterprise might be conducted with the greater secrecy, he suffered not the least hint of his design to transpire, even amongst any of his officers. On the contrary, in order to blind them, he detached A. Manlius, one of his lieutenants, with some light-armed cohorts, to the city of Lares, where he had fixed his principal magazine, and deposited the military chest. Before Manlius left the camp, that he might the more effectually amuse him, he intimated, that himself with the army should take the same route in a few days: but instead of that, he bent his march towards the Tanais, and in six days time arrived upon the banks of that river. Here he pitched his tents for a short time, in order to refresh his troops; which having done, he advanced to Capsa, and made himself master of it. As

17 He gains a great vantage over Jugurtha.

Numidia. As the situation of this city rendered it extremely commodious to Jugurtha, whose plan of operations, ever since the commencement of the war, it had exceedingly favoured, he levelled it with the ground after it had been delivered up to the soldiers to be plundered. The citizens likewise, being more strongly attached to that prince than any of the other Numidians, on account of the extraordinary privileges he indulged them with, and of course bearing a more implacable hatred to the Romans, he put to the sword or sold for slaves. The true motive of the consul's conduct on this occasion seems here to be assigned; though we are told by Sallust, in conformity to the Roman genius, that neither avarice nor resentment prompted him to so barbarous an action, but only a desire to strike a terror into the Numidians.

The Numidians, ever after this exploit, dreaded the very name of Marius; who now, in his own opinion, had eclipsed the glory of all his predecessor's great achievements, particularly the reduction of Thala, a city, in strength and situation, nearly resembling Capsa. Following his blow, he gradually presented himself before most of the places of strength in the enemy's country; many of which either opened their gates, or were abandoned, at his approach, being terrified with what had happened to the unfortunate citizens of Capsa. Others taken by force, he laid in ashes; and in short filled the greatest part of Numidia with blood, horror, and confusion. Then, after an obstinate defence, he reduced a castle that seemed impregnable, seated not far from Mulucha, where Jugurtha kept part of his treasures. In the mean time, Jugurtha not being able to prevail upon Bocchus, by his repeated solicitations, to advance into Numidia, where he found himself greatly pressed, was obliged to have recourse to his usual method of bribing the Mauritanian ministers, in order to put that prince in motion. He also promised him a third part of his kingdom, provided they could either drive the Romans out of Africa, or get all the Numidian dominions confirmed to him by treaty.

So considerable a cession could not fail of engaging Bocchus to support Jugurtha with his whole power. The two African monarchs, therefore, having joined their forces, surprised Marius near Cirta as he was going into winter quarters. The Roman general was so pushed on this occasion, that the barbarians thought themselves certain of victory, and doubted not but they should be able to extinguish the Roman name in Numidia. But their incaution and too great security enabled Marius to give them a total defeat; which was followed four days after by so complete an overthrow, that their numerous army, consisting of 90,000 men, by the accession of a powerful corps of Moors, commanded by Bocchus's son Volux, was entirely ruined. Sylla, Marius's lieutenant, most eminently distinguished himself in the last action, which laid the foundation of his future greatness. Bocchus, now looking upon Jgurtha's condition as desperate, and not being willing to run the risk of losing his dominions, showed a disposition to clap up a peace with Rome. However, the republic gave him to understand, that he must not expect to be ranked amongst its friends, till he had delivered up into the consul's hands Jugurtha, the inveterate enemy of the Roman name. The Mauritanian monarch, having entertained a high idea of an alliance

18 Jugurtha entirely defeated.

with that state, resolved to satisfy it in this particular; and was confirmed in his resolution by one Dabar, a Numidian prince, the son of Massugrada, and descended by his mother's side from Masinissa. Being closely attached to the Romans, and extremely agreeable to Bocchus, on account of his noble disposition, he defeated all the intrigues of Aspar, Jugurtha's minister. Upon Sylla's arrival at the Mauritanian court, the affair there seemed to be entirely settled. However, Bocchus, who was for ever projecting new designs, and, like, the rest of his countrymen, in the highest degree perfidious, debated within himself, whether he should sacrifice Sylla or Jugurtha, who were both then in his power. He was a long time fluctuating with uncertainty, and combated by a contrariety of sentiments. The sudden changes which displayed themselves in his countenance, his air, and his whole person, evidently showed how strongly his mind was agitated. But at last he returned to his first design, to which the bias of his mind seemed naturally to lead him. He therefore delivered up Jugurtha into the hands of Sylla, to be conducted to Marius; who, by that successful event, happily terminated this dangerous war. The kingdom of Numidia was now reduced to a new form: Bocchus, for his important services, had the country of the Massæsyli, contiguous to Mauritania, assigned him: which, from this time, took the name of *New Mauritania.* Numidia Propria, or the country of the Massyli, was divided into three parts; one of which was given to Hiempsal, another to Mandrestal, both descendants of Masinissa; and the third the Romans annexed to Africa Propria, or the Roman province adjacent to it. What became of Jugurtha after he had graced Marius's triumph, at which ceremony he was led in chains, together with his two sons, through the streets of Rome, we have already laid before our readers. See JUGURTHA.

Jugurtha's two sons survived him, but spent their lives in captivity at Venusia. However, one of them, named *Oxyntas*, was, for a short time, released from his confinement by Aponius, who besieged Acerræ in the war between the Romans and the Italian allies. That general brought this prince to his army, where he treated him as king, in order to draw the Numidian forces off from the Roman service. Accordingly those Numidians no sooner heard that the son of their old king was fighting for the allies, than they began to desert by companies; which obliged Julius Cæsar the consul to part with all his Numidian cavalry, and send them back into Africa. Some few years after this event, Pompey defeated Cneius Domitius Ahenobarbus, and Hiarbas one of the kings of Numidia, killing 17,000 of their men upon the spot. Not satisfied with this victory, that general pursued the fugitives to their camp, which he soon forced, put Domitius to the sword, and took Hiarbas prisoner. He then reduced that part of Numidia which belonged to Hiarbas, who seems to have succeeded Mandrestal above-mentioned; and gave it to Hiempsal, a neighbouring Numidian prince, descended from Masinissa, who had always opposed the Marian faction.

19 Transactions after the death of Jugurtha.

Suetonius informs us, that a dispute happened between Hiempsal and one Masintha, a noble Numidian, whom, it is probable, he had in some respect injured, when Julius Cæsar first began to make a figure in the world. The same author adds, that Cæsar warmly espoused

20 Cæsar insults Juba.

Numidia. espoused the cause of Masintha, and even grossly insulted Juba, Hiempsal's son, when he attempted to vindicate his father's conduct on this occasion. He pulled him by the beard, than which a more unpardonable affront could not be offered to an African. In short, he screened Masintha from the insults and violence of his enemies; from whence a reason may be assigned for Juba's adhering so closely afterwards to the Pompeian faction.

21
Juba defeats one of Cæsar's lieutenants.

In consequence of the indignity Cæsar had offered Juba, and the disposition it had occasioned, that prince did Cæsar great damage in the civil wars betwixt him and Pompey. By a stratagem he drew Curio, one of his lieutenants, into a general action, which it was his interest at that time to have avoided. He caused it to be given out over all Africa Propria and Numidia, that he was retired into some remote country at a great distance from the Roman territories. This coming to Curio's ears, who was then besieging Utica, it hindered him from taking the necessary precautions against a surprise. Soon after, the Roman general receiving intelligence that a small body of Numidians was approaching his camp, he put himself at the head of his forces in order to attack them, and for fear they should escape, began his march in the night, looking upon himself as sure of victory. Some of their advanced posts he surprised asleep, and cut them to pieces; which still farther animated him. In short, about daybreak he came up with the Numidians, whom he attacked with great bravery, though his men were then fasting, and vastly fatigued by their forced and precipitate march. In the mean time, Juba, who immediately after the propagation of the rumour above mentioned, had taken care to march privately, with the main body of the Numidian army, to support the detachment sent before to decoy Curio, advanced to the relief of his men. The Romans had met with a great resistance before he appeared; so that he easily broke them, killed Curio, with a great part of his troops, upon the spot, pursued the rest to their camp, which he plundered, and took many of them prisoners. Most of the fugitives, who endeavoured to make their escape on board the ships in the port of Utica, were either slain by the pursuers, or drowned. The remainder fell into the hands of Varus, who would have saved them; but Juba, who arrogated to himself the honour of this victory, ordered most of them to be put to the sword.

22
Juba overthrown by Cæsar.

This victory infused new life and vigour into the Pompeian faction, who thereupon conferred great honours upon Juba, and gave him the title of *king of all Numidia*. But Cæsar and his adherents declared him an enemy to the state of Rome, adjudging to Bocchus and Bogud, two African princes entirely in their interest, the sovereignty of his dominions. Juba afterwards, uniting his forces with those of Scipio, reduced Cæsar to great extremities, and would in all probability have totally ruined him, had he not been relieved by Publius Sittius. That general, having formed a considerable corps, consisting of Roman exiles, and Mauritanian troops sent him by Bocchus, according to Dio, or, as Cæsar, will have it, Bogud, made an irruption into Gætulia and Numidia, while Juba was employed in Africa Propria. As he ravaged these countries in a dreadful manner, Juba immediately returned with the best part of his army, to preserve them from utter destruction. However, Cæsar knowing his horse to be afraid of the enemy's elephants, did not think proper to attack Scipio in the absence of the Numidian, till his own elephants, and a fresh reinforcement of troops, hourly expected, arrived from Italy. With this accession of strength, he imagined himself able to give a good account, both of the Roman forces with which he was to cope, and the barbarians. In the mean time Scipio despatched reiterated expresses to Juba to hasten to his assistance; but could not prevail upon him to move out of Numidia, till he had promised him the possession of all the Roman dominions in Africa, if they could from thence expel Cæsar. This immediately put him in motion; so that, having sent a large detachment to make head against Sittius, he marched with the rest of his troops to assist Scipio. However, Cæsar at last overthrew Scipio, Juba, and Labienus, near the town of Thapsus, and forced all their camps. As Scipio was the first surprised and defeated, Juba fled into Numidia without waiting for Cæsar's approach; but the body of the Numidians detached against Sittius, having been broken and dispersed by that general, none of his subjects there would receive him. Abandoned therefore to despair he sought death in a single combat with Petreius, and having killed him, caused himself to be despatched by one of his slaves.

23
Numidia reduced to the form of a province.

After this decisive action, and the reduction of Africa Propria, Cæsar made himself master of Numidia, which he reduced to a Roman province, appointing Crispus Sallustius to govern it in quality of proconsul, with private instructions to pillage and plunder the inhabitants, and, by that means put it out of their power ever to shake off the Roman yoke. However, Bocchus and Bogud still preserved a sort of sovereignty in the country of the Massæsyli and Mauritania, since the former of those princes, having deserted Cæsar, sent an army into Spain to assist the Pompeians; and the latter, with his forces, determined victory to declare for Cæsar at the ever memorable battle of Munda. Bogud, afterwards siding with Antony against Octavius, sent a body of forces to assist him in Spain; at which time the Tingitanians revolting from him, Bocchus, with an army composed of Romans in the interest of Octavius, who passed over from Spain into Africa, and his own subjects, possessed himself of Mauritania Tingitana. Bogud fled to Antony; and Octavius, after the conclusion of the war, honoured the inhabitants of Tingi with all the privileges of Roman citizens. He likewise confirmed Bocchus king of Mauritania Cæsariensis, or the country of the Massæsyli, in the possession of Tingitana, which he had conquered, as a reward for his important services. In this he imitated the example of his great predecessor Julius Cæsar, who divided some of the fruitful plains of Numidia among the soldiers of P. Sittius, who had conquered great part of that country, and appointed Sittius himself sovereign of that district. Sittius, as has been intimated above, having taken Cirta, killed Sabura, Juba's general, entirely dispersed his forces, and either cut off or taken prisoners most of the Pompeian fugitives that escaped from the battle of Thapsus, highly deserved to be distinguished in so eminent a manner. After Bocchus's death, Mauritania and the Massæsylian Numidia were in all respects considered as Roman provinces.

Numismatographia.

NUMISMATOGRAPHIA, a term used for the description

description and knowledge of ancient coins and medals, whether of gold, silver, or brass. See COINS and MEDALS.

NUMITOR, the son of Procas king of Alba, and the brother of Amulius. Procas before his death made him and Amulius joint heirs to the crown, on condition of their reigning annually by turns: but Amulius, on getting possession of the throne, excluded Numitor, whose son Lausus he ordered to be put to death, and obliged Rhea Sylvia, Numitor's only daughter, to become a vestal. This princess becoming pregnant, declared that she was with child by the god Mars; and afterwards brought forth Remus and Romulus, who at length killed Amulius, and restored Numitor to the throne, 754 B. C. See REMUS and ROMULUS.

NUMMUS, a piece of money, otherwise called *sestertius*.

NUN, the son of Elishamah, and father of Joshua, of the tribe of Ephraim. The Greeks gave him the name of *Nane* instead of Nun. This man is known in sacred history only by being the father of Joshua.

NUN, a woman, in several Christian countries, who devotes herself, in a cloister or nunnery, to a religious life. See the article MONK.

There were women, in the ancient Christian church, who made public profession of virginity, before the monastic life was known in the world, as appears from the writings of Cyprian and Tertullian. These, for distinction's sake, are sometimes called *ecclesiastical virgins*, and were commonly enrolled in the canon or matricula of the church. They differed from the monastic virgins chiefly in this, that they lived privately in their fathers houses, whereas the others lived in communities: but their profession of virginity was not so strict as to make it criminal for them to marry afterwards, if they thought fit. As to the consecration of virgins, it had some things peculiar in it; it was usually performed publicly in the church by the bishop. The virgin made a public profession of her resolution, and then the bishop put upon her the accustomed habit of sacred virgins. One part of this habit was a veil, called the *sacrum velamen;* another was a kind of mitre or coronet worn upon the head. At present, when a woman is to be made a nun, the habit, veil, and ring of the candidate are carried to the altar; and she herself, accompanied by her nearest relations, is conducted to the bishop, who, after mass and an anthem, (the subject of which is "that she ought to have her lamp lighted, because the bridegroom is coming to meet her)," pronounces the benediction: then she rises up, and the bishop consecrates the new habit, sprinkling it with holy water. When the candidate has put on her religious habit, she presents herself before the bishop, and sings, on her knees, *Ancilla Christi sum*, &c.; then she receives the veil, and afterwards the ring, by which she is married to Christ; and lastly, the crown of virginity. When she is crowned, an anathema is denounced against all who shall attempt to make her break her vows. In some few instances, perhaps, it may have happened that nunneries, monasteries, &c. may have been useful as well to morality and religion as to literature: in the gross, however, they have been highly prejudicial; and however well they might be supposed to do when viewed in theory, in fact they are unnatural and impious. It was surely far from the intention of Providence to seclude youth and beauty in a cloistered ruin, or to deny them the innocent enjoyment of their years and sex.

NUNCIO, or NUNTIO, an ambassador from the pope to some Catholic prince or state, or a person who attends on the pope's behalf at a congress, or an assembly of several ambassadors.

NUNCUPATIVE, in the schools, something that is only nominal, or has no existence but in name.

NUNCUPATIVE Will or *Testament*, a will made verbally, and not put in writing. See the articles WILL and TESTAMENT.

NUNDINA, a goddess among the ancient heathens, supposed to have the care of the purification of infants. And because male infants were purified nine days after their birth, her name is derived from *nonus*, or the ninth, though female infants were purified the eighth day; which purification was called *lustration* by the Romans.

NUNDINAL, *Nundinalis*, a name which the Romans gave to the eight first letters of the alphabet used in their kalendar.

This series of letters, A, B, C, D, E, F, G, H, is placed and repeated successively from the first to the last day of the year: one of these always expressed the market days or the assemblies called *nundinæ*, *quasi novendinæ*, because they returned every nine days. The country people, after working eight days successively, came to town the ninth, to sell their several commodities, and to inform themselves of what related to religion and government. Thus the nundinal day being under A on the first, ninth, seventeenth, and twenty-fifth days of January, &c. the letter D will be the nundinal letter of the year following. These nundinals bear a very great resemblance to the dominical letters, which return every eight days, as the nundinals did every nine.

NUNDOCOMAR, a Rajah in Bengal, and head of the Bramins, who, in 1775, was condemned to an ignominious death by English laws newly introduced, in an English court of justice newly established, for a forgery charged to have been committed by him many years before. That he was guilty of the deed cannot be questioned; but there was surely something hard in condemning a man by an *ex post facto* law. He bore his fate with the utmost fortitude, in the full confidence that his soul would soon be reunited to the universal spirit whence it had sprung. See METAPHYSICS, Part III. Chap. IV. *Of the Immortality of the Soul.*

MONTE NUOVO, in the environs of Naples, blocks up the valley of Averno. "This mountain (Mr Swinburne tells us) arose in the year 1538; for after repeated quakings, the earth burst asunder, and made way for a deluge of hot ashes and flames, which rising extremely high, and darkening the atmosphere, fell down again and formed a circular mound four miles in circumference, and 1000 feet high, with a large cup in the middle. The wind rising afterwards, wafted the lighter particles over the country, blasted vegetation, and killed the animals who grazed; the consequence was, that the place was deserted, till Don Pedro de Toledo, viceroy of Naples, encouraged the inhabitants, by example and otherwise to return.

"Part of Monte Nuovo is cultivated, but the larger portion of its declivity is wildly overgrown with prickly broom, and rank weeds that emit a very fetid sulphureous smell. The crater is shallow, its inside clad with shrubs, and the little area at the bottom planted with fig and mulberry trees; a most striking specimen of the amazing vicissitudes that take place in this extraordinary country. I saw no traces of lava or melted matter, and few stones within.

"Near the foot of this mountain the subterraneous fires act with such immediate power, that even the sand at the bottom of the sea is heated to an intolerable degree."

NUPTIAL RITES, the ceremonies attending the solemnization of marriage, which are different in different ages and countries. We cannot omit here a custom which was practised by the Romans on these occasions; which was this: Immediately after the chief ceremonies were over, the new married man threw *nuts* about the room for the boys to scramble for. Various reasons have been assigned for it; but that which most generally prevails, and seems to be the most just, is, that by this act the bridegroom signified his resolution to abandon trifles, and commence a serious course of life; whence *nucibus relictis* in this sense became a proverb. They might also be an emblem of fertility.

The ancient Greeks had a person to conduct the bride from her own to the bridegroom's house; and hence he was called by the Greeks *Nymphagogus*, which term was afterwards used both by the Romans and the Jews.

NUREMBERG, an imperial city of Germany, capital of a territory of the same name, situated in E. Long. 11. N. Lat. 47. 30. It stands on the Regnitz, over which it has several bridges, both of wood and stone, at the bottom of a hill, 60 miles from Augsburg, 87 from Munich, 46 from Wurtzburg, and 50 from Ratisbon; and is thought by some to be the Segodunum, and by others the Castrum Noricum of the ancients.

The city has derived its name from the hill, upon which stands this castle, called, in Latin, Castrum Noricum, round which the city was begun to be built, and where the emperors formerly lodged; and here they lodge still, when they pass by that city. They there preserve, as precious relicks, the crown, sceptre, clothes, buskins, and other ornaments of Charlemagne (A), which served also the emperor Leopold, when he went thither after his election, to receive the homage of the city. The small river Regnitz, which runs through it, and those of Rednitz and Schwarzack, which pass by its walls, furnish the inhabitants, besides other advantages, with the means of making all sorts of stuffs, dyes, and other manufactures (B), and toys, which are carried and sold even in the Indies.

It is a large and well-built town, but not very populous. Its fortifications are a double wall, flanked with towers mounting cannon, and a deep ditch. The magistrates, and most of the inhabitants, are Lutherans. There are a great many churches and chapels in it. In that of St Sebald is a brass monument of the saint; and a picture, representing the creation of the world, by the celebrated Albert Durer, who was a native of the town; but the finest church in the town is that of St Giles. In that of the Holy Ghost are kept most of the jewels of the empire, together with the pretended spear with which our Saviour's side was pierced, a thorn of his crown, and a piece of the manger wherein he was laid. Here are also a great many hospitals, one in particular for foundlings, and another for pilgrims; with a gymnasium, an anatomical theatre, a granary, a fine public library, the old imperial fortress or castle, some remains of the old citadel of the burgraves of Nuremberg, several Latin schools, an academy of painting, a well furnished arsenal, a Teutonic house in which the Roman Catholic service is tolerated, and a mint. Mr Keysler says, there are upwards of 500 streets in it, about 140 fountains, 16 churches, 44 religious houses, 12 bridges, 10 market places, and 25,000 inhabitants; and that its territories, besides the capital and four other towns, contain above 500 villages, and about 160 mills on the Regnitz. The trade of this city, though upon the decline, is still very great, many of its manufactures being still exported to all parts of the world; among which may be reckoned a great variety of curious toys in ivory, wood, and metal, already mentioned. The city has also distinguished itself in the arts of painting and engraving. When the emperor Henry VI. assisted at a tournament in Nuremberg, he raised 38 burghers to the degree of nobility, the descendants of whom are called *patricians*, and have the government of the city entirely in their hands; the whole council, except eight masters of companies, who are summoned only on extraordinary occasions, consisting of them. Among the fine brass cannon in the arsenal, is one that is charged at the breech, and may be fired eight times in a minute; and two that carry balls of eighty pounds. The city keeps, in constant pay, seven companies, consisting each, in time of peace, of 100 men, but, in time of war, of 185; two troops of cuirassiers, each consisting of 85 men; and two companies of invalids. There are also 24 companies of burghers, well armed and disciplined. On the new bridge, which is said to have cost 100,000 guilders, are two pyramids, on the top of one of which is a dove with an olive branch in her bill, and on the other an imperial black eagle. Music also flourishes greatly in Nuremberg; and those who delight in mechanic

(A) These ornaments are, a mitred crown, enriched with rubies, emeralds, and pearls; the dalmatio of Charlemagne, richly embroidered; the imperial mantle powdered with embroidered eagles, and its border thick set with large emeralds, sapphires, and topazes; the buskins covered with plates of gold; the gloves embroidered; the apple, the golden sceptre, and sword. The ancient custom of the empire is, that the emperor is bound to assemble in this city the first diet that he holds after his election and coronation.

(B) There is in Nuremberg, and in the neighbouring villages depending upon it, an infinite number of workmen, very ingenious in making several kinds of toys of wood, which are carried through all the fairs of Germany, and from thence through all Europe. These toys are called Nurembergs; and they have so great a sale, that it even exceeds description. This employment affords a livelihood to the greatest part of the inhabitants of the city; and they make a very considerable profit from this traffic.

Nuremberg | Nursing.

mechanic arts and manufactures cannot anywhere better gratify their curiosity. As an imperial city, it has a seat and voice at the diets of the empire and circle, paying to the chamber of Wetzlar 812 rixdollars each term. The territory belonging to the city is pretty large, containing, besides two considerable forests of pine, called the *Sibald* and *Laurence forests*, several towns and villages.

We have mentioned already that certain families called patricians, to the exclusion of the rest, possess the offices of the senate. They are composed of 42 persons (C), over which two castellans, or perpetual seneschals, preside, the first of whom has his residence in the castle. These castellans assemble sometimes in the castle, with five or six of the chief members, to hold a secret council (D). And, as this city glories in being one of the first which embraced Lutheranism, it preserves the privilege of that in civil matters, not admitting any Catholics to the magistracy or freedom of the town; the Catholics there having the liberty only of remaining under the protection of the rest, and performing their religious worship in a commandery of Malta, and this but at certain hours, not to disturb the Lutherans, who likewise assemble there, although in possession of all the other churches.

This city is particularly noted for its antiquity, grandeur, fortifications, its triple walls of hewn stone, its large and deep moat, its fine houses, large churches, its wide streets, always clean, and for its curious and large library, and its magazine stored with every thing proper for its defence.

NURSERY, in *Gardening*, is a piece of land set apart for raising and propagating all sorts of trees and plants to supply the garden and other plantations.

NURSING OF CHILDREN. See LACTATIO.

The following observations and directions are said to be the result of long experience †. The child should be laid (the first month) upon a thin mattress, rather longer than itself, which the nurse will keep upon her lap, that the child may always lie straight, and only sit up as the nurse slants the mattress. To set a child quite upright before the end of the first month, hurts the eyes, by making the white part of the eye appear below the upper eyelid. Afterwards the nurse will begin to set it up and dance it by degrees. The child must be kept as dry as possible.

† *An. Reg.* vol. vi. p. 130.

The clothing should be very light, and not much longer than the child, that the legs may be got at with ease, in order to have them often rubbed in the day with a warm hand or flannel, and in particular the inside of them.

Rubbing a child all over takes off scurf, and makes the blood circulate. The one breast should be rubbed with the hands one way, and the other the other way, night and morning at least.

The ankle bones and inside of the knees should be rubbed twice a-day; this will strengthen those parts, and make the child stretch its knees and keep them flat, which is the foundation of an erect and graceful person.

A nurse ought to keep a child as little in her arms as possible, lest the legs should be cramped, and the toes turned inwards. Let her always keep the child's legs loose. The oftener the posture is changed, the better.

Tossing a child about, and exercising it in the open air in fine weather, is of the greatest service. In cities, children are not to be kept in hot rooms, but to have as much air as possible.

Want of exercise is the cause of large heads, weak and knotted joints, a contracted breast, which occasions coughs and stuffed lungs, an ill-shaped person, and waddling gait, besides a numerous train of other ills.

The child's flesh is to be kept perfectly clean, by constantly washing its limbs, and likewise its neck and ears, beginning with warm water, till by degrees it will not only bear, but like to be washed with cold water.

Rising early in the morning is good for all children, provided they awake of themselves, which they generally do: but they are never to be waked out of their sleep, and as soon as possible to be brought to regular sleeps in the day.

When laid in bed or cradle, their legs are always to be laid straight.

Children, till they are two or three years old, must never be suffered to walk long enough at a time to be weary.

Girls might be trained to the proper management of children, if a premium were given in free schools, workhouses, &c. to those that brought up the finest child to one year old.

If the mother cannot suckle the child, get a wholesome cheerful woman with young milk, who has been used to tend young children. After the first six months, small broths, and innocent foods of any kind, may do as well as living wholly upon milk.

A principal thing to be always attended to is, to give young children constant exercise, and to keep them in a proper posture.

With regard to the child's dress in the day, let it be a shirt; a petticoat of fine flannel, two or three inches longer than the child's feet, with a dimity top (commonly called a *bodice coat*), to tie behind; over that a surcingle made of fine buckram, two inches broad, covered over with satin or fine ticken, with a ribbon fastened to it to tie it on, which answers every purpose of stays, and has none of their inconveniences. Over this put a robe, or a slip and frock, or whatever you like best; provided it is fastened behind, and not much longer than the child's feet, that their motions may be strictly observed.

Two

(C) Of these 42 members, there are only 34 chosen from the patrician families; the other eight are taken from among the burghers, and make in a manner a small separate body.

(D) This secret council is composed of seven principal chiefs of the republic, and for that reason is called *septemvirate*. It determines the most important affairs; and is the depository of the precious stones of the empire, of the imperial crown, the ensigns, seals, and keys of the city.

Two caps are to be put on the head, till the child has got most of its teeth.

The child's dress for the night may be a shirt, a blanket to tie on, and a thin gown to tie over the blanket.

NUSANCE, or NUISANCE, in *Law*, a thing done to the annoyance of another.

Nuisances are either public or private.—A public nuisance is an offence against the public in general, either by doing what tends to the annoyance of all the king's subjects, or by neglecting to do what the common good requires: in which case, all annoyances and injuries to streets, highways, bridges, and large rivers, as also disorderly alehouses, bawdy-houses, gaming houses, stages for rope-dancers, &c. are held to be common nuisances.—A private nuisance is, when only one person or family is annoyed by the doing of any thing; as where a person stops up the light of another's house, or builds in such a manner that the rain falls from his house upon his neighbour's.

NUT, among botanists, denotes a PERICARPIUM of an extraordinary hardness, enclosing a kernel or seed.

NUTATION, in *Astronomy*, a kind of tremulous motion of the axis of the earth, whereby, in each annual revolution, it is twice inclined to the ecliptic, and as often returns to its former position.

NUTCRACKER. See CORVUS, ORNITHOLOGY *Index*.

NUTHATCH. See SITTA, ORNITHOLOGY *Index*.

NUTMEG, the fruit of a tree, and a well known spice. See MYRISTICA.

NUTRITION, in the animal economy, is the repairing the continual loss which the different parts of the body undergo. The motion of the parts of the body, the friction of these parts with each other, and especially the action of the air, would destroy the body entirely, if the loss was not repaired by a proper diet, containing nutritive juices; which being digested in the stomach, and afterwards converted into chyle, mix with the blood, and are distributed through the whole body for its nutrition.

In young persons, the nutritive juices not only serve to repair the parts that are damaged, but also to increase them; which is called *growth*.

In grown persons, the cuticle is everywhere constantly desquamating, and again renewing; and in the same manner the parts rubbed off, or otherwise separated from the fleshy parts of the body, are soon supplied with new flesh; a wound heals, and an emaciated person grows plump and fat.

Buffon, in order to account for nutrition, supposes the body of an animal or vegetable to be a kind of mould, in which the matter necessary to its nutrition is modelled and assimilated to the whole. But (continues he) of what nature is this matter which an animal or vegetable assimilates to its own substance? What power is it that communicates to this matter the activity and motion necessary to penetrate this mould? and, if such a force exist, would it not be by a similar force that the internal mould itself might be reproduced?

As to the first question, he supposes that there exists in nature an infinite number of living organical parts, and that all organized bodies consist of such organical parts; that their production costs nature nothing, since their existence is constant and invariable; so that the matter which the animal or vegetable assimilates to its substance, is an organical matter of the same nature with that of the animal or vegetable, which consequently may augment its volume without changing its form or altering the quality of the substance in the mould.

As to the second question: There exist (says he) in nature certain powers, as that of gravity, that have no affinity with the external qualities of the body, but act upon the most intimate parts, and penetrate them throughout, and which can never fall under the observation of our senses.

And as to the third question, he answers that the internal mould itself is reproduced, not only by a similar power, but it is plain that it is the very same power that causes the unfolding and reproduction thereof: for it is sufficient (proceeds he), that in an organized body that unfolds itself, there be some part similar to the whole, in order that this part may one day become itself an organised body, altogether like that of which it is actually a part.

NUX MOSCHATA. See MYRISTICA.

Nux Pistachia. See PISTACHIA, BOTANY *Index*.

Nux Vomica, a flat, compressed, round fruit, about the breadth of a shilling, brought from the East Indies. It is found to be a certain poison for dogs, cats, &c. and it is not to be doubted that it would also prove fatal to mankind. Its surface is not much corrugated; and its texture is firm like horn, and of a pale grayish-brown colour. It is said to be used as a specific against the bite of a species of water-snake. It is considerably bitter and deleterious; but has been used in doses from five to ten grains twice a-day or so, in intermittents, particularly obstinate quartans, and in contagious dysentery. The *strychnus Ignatii* is a tree of the same kind, producing gourd-like fruit, the seeds of which are improperly called St Ignatius's beans. These, as also the woods or roots of some such trees, called *lignum colubrinum*, or *snakewood*, are very narcotic bitters, like the nux vomica.

NUYTS, PETER, a native of Holland, and a leading character in that extraordinary transaction which happened between the Japanese and the Dutch about the year 1628. In 1627 Nuyts arrived in Batavia from Holland, and was in the same year appointed ambassador to the emperor of Japan by the governor and council of Batavia.

He repaired to that empire in 1628; and being a man of a haughty disposition, and extremely vain, he believed it practicable to pass upon the natives for an ambassador from the king of Holland. Upon his assuming this title he was much more honourably received, caressed, and respected, than former ministers had been. But he was soon detected, reprimanded, and reproached in the severest manner, sent back to the port, and ordered to return to Batavia with all the circumstances of disgrace imaginable; notwithstanding which, his interest was so great, that, instead of being punished as he deserved, he was immediately afterwards promoted to the government of the island of Formosa, of which he took possession the year following.

He entered upon the administration of affairs in that island with the same disposition that he had shown while ambassador, and with the most implacable resentment against

against the Japanese; neither was it long before an opportunity offered, as he thought, of revenging himself to the full. Two large Japanese ships, with upwards of 500 men on board, came into the port; upon which he took it into his head to disarm and unrig them, in the same manner as the Dutch vessels are treated at Japan. The Japanese did all they could to defend themselves from this ill usage; but at last, for want of water, they were forced to submit. Governor Nuyts went still farther. When they had finished their affairs at Formosa, and were desirous of proceeding, according to their instructions, to China, he put them off with fair words and fine promises till the monsoon was over. They began then to be very impatient, and desired to have their cannon and sails restored, that they might return home; but the governor had recourse to new artifices, and, by a series of false promises, endeavoured to hinder them from making use of the season proper for that voyage.

The Japanese, however, soon perceived his design; and at length, by a bold attempt, accomplished what by fair means and humble entreaty they could not obtain; for, by a daring and well concerted effort, they took him prisoner, and made him and one of the council sign a treaty for securing their liberty, free departure, and indemnity, which was afterwards ratified by the whole council. Nuyts was first confined in Batavia, and afterwards delivered up to the Japanese, notwithstanding the most earnest entreaties on his part to be tried, and even to suffer any kind of death where he was, rather than to be sent to Japan. He was sent there, however, in 1634. He was submitted to the mercy or discretion of the emperor; and the consequence was, that, though imprisoned, he was well used, and could go anywhere, provided his guards were with him, which was more than he could possibly have expected. He now looked for nothing but the continuance of his confinement for life. On a particular occasion, however, i. e. at the funeral of the emperor's father, at the request of the Dutch he was set free, and returned again to Batavia, to the surprise of that people, who, however, adopted ever after a very different conduct with respect to the Japanese.

NUZZER, or NUZZERANAH; a present or offering from an inferior to a superior. In Hindostan no man ever approaches his superior for the first time on business without an offering of at least a gold or silver rupee in his right hand; which, if not taken, is a mark of disfavour. Nuzzeranah is also used for the sum paid to the government as an acknowledgement for a grant of lands or any public office.

NYCHTHEMERON, among the ancients, signified the whole natural day, or day and night consisting of 24 hours, or 24 equal parts. This way of considering the day was particularly adopted by the Jews, and seems to owe its origin to that expression of Moses, in the first chapter of Genesis, "the evening and the morning were the first day."—Before the Jews had introduced the Greek language into their discourse, they used to signify this space of time by the simple expression of a night and a day.

It is proper here to observe, that all the eastern countries reckoned any part of a day of 24 hours for a whole day; and say thing a that was done on the third or seventh day, &c. from that last mentioned, was done after three or seven days. And the Hebrews, having no word which exactly answers to the Greek Νυχθημερον, signifying "a natural day of 24 hours," use *night and day*, or *day and night*, for it. So that to say a thing happened after three days and three nights, was, with them, the same as to say it happened after three days, or on the third day. This, being remembered, will explain what is meant by "the Son of Man's being three days and three nights in the heart of the earth."

NYCTALOPIA. See MEDICINE, N° 361.

NYCTANTHES, ARABIAN JASMINE, a genus of plants, belonging to the diandria class, and in the natural method ranking with the 44th order, *Sepiariæ*. See BOTANY *Index*.

NYCTASTRATEGI, among the ancients, were officers appointed to prevent fires in the night, or to give alarm and call assistance when a fire broke out. At Rome they had the command of the watch, and were called *nocturni triumviri*, from their office and number.

NYCTICORAX, the night raven; a species of ARDEA. See ARDEA, ORNITHOLOGY *Index*.

NYLAND, a province of Finland in Sweden, lying on the gulf of Finland, to the west of the province of Carelia.

NYL-GHAU, a species of quadrupeds belonging to the genus *Bos*, a native of the interior parts of India. See MAMMALIA *Index*.

NYMPH, in *Mythology*, an appellation given to certain inferior goddesses, inhabiting the mountains, wood, waters, &c. said to be the daughters of Oceanus and Tethys. All the universe was represented as full of these nymphs, who are distinguished into several ranks or classes. The general division of them is into celestial and terrestrial; the former of them were called *uraniæ*, and were supposed to be intelligences that governed the heavenly bodies or spheres. The terrestrial nymphs, called *epigeiæ*, presided over the several parts of the inferior world; and were divided into those of the water, and those of the earth. The nymphs of the water were the *oceanitides*, or nymphs of the ocean; the *nereids*, the nymphs of the sea; the *naiads* and *ephydriades*, the nymphs of the fountains; and the *limniades*, the nymphs of the lakes. The nymphs of the earth were the *oreades*, or nymphs of the mountains; the *napææ*, nymphs of the meadows; and the *dryads* and *hamadryads*, who were nymphs of the forests and groves. Besides these, we meet with nymphs who took their names from particular countries, rivers, &c. as the *cithæroniades*, so called from Mount Cithæron in Bœotia: the *dodonides*, from Dodona; *tiberiades*, from the Tiber, &c.—Goats were sometimes sacrificed to the nymphs; but their constant offerings were milk, oil, honey, and wine.

We have the following account of nymphs in Chandler's Greece. "They were supposed to enjoy longevity, but not to be immortal. They were believed to delight in springs and fountains. They are described as sleepless, and as dreaded by the country people. They were susceptible of passion. The Argonauts, it is related, landing on the shore of the Propontis to dine in their way to Colchos, sent Hylas, a boy, for water, who discovered a lonely fountain, in which the nymphs Eunica, Malis, and Nycheia, were preparing to dance; and these seeing him were enamoured, and, seizing him by the hand

hand as he was filling his vase, pulled him in. The deities, their copartners in the cave, are such as presided with them over rural and pastoral affairs.

"The old Athenians were ever ready to cry out, A god! or a goddess! The tyrant Pisistratus entered the city in a chariot with a tall woman dressed in armour to resemble Minerva, and regained the Acropolis, which he had been forced to abandon, by this stratagem; the people worshipping, and believing her to be the deity whom she represented. The nymphs, it was the popular persuasion, occasionally appeared; and nympholepsy is characterised as a frenzy, which arose from having beheld them. Superstition disposed the mind to adopt delusion for reality, and gave to a fancied vision the efficacy of full conviction. The foundation was perhaps no more than an indirect, partial, or obscure view of some harmless girl, who had approached the fountain on a like errand with Hylas, or was retiring after she had filled her earthen pitcher.

"Among the sacred caves on record, one on Mount Ida in Crete was the property of Jupiter, and one by Lebadea in Bœotia of Trophonius. Both these were oracular, and the latter bore some resemblance to that we have described. It was formed by art, and the mouth surrounded with a wall. The descent to the landing place was by a light and narrow ladder, occasionally applied and removed. It was situated on a mountain above a grove; and they related, that a swarm of bees conducted the person by whom it was first discovered. But the common owners of caves were the nymphs, and these were sometimes local. On Cithæron in Bœotia, many of the inhabitants were possessed by nymphs called *Sphragitides*, whose cave, once also oracular, was on a summit of the mountain. Their dwellings had generally a well or spring of water; the former often a collection of moisture condensed or exuding from the roof and sides; and this, in many instances, being pregnant with stony particles, concreted, and marked its passage by incrustation, the groundwork in all ages and countries of idle tales framed or adopted by superstitious and credulous people.

"A cave in Paphlagonia was sacred to the nymphs who inhabited the mountains about Heraclea. It was long and wide, and pervaded by cold water, clear as crystal. There also were seen bowls of stone, and nymphs and their webs and distaffs, and curious work, exciting admiration. The poet who has described this grotto, deserves not to be regarded, as servilely copying Homer; he may justly lay claim to rank as an original topographer.

"The piety of Archidamus furnished a retreat for the nymphs, where they might find shelter and provision, if distressed; whether the sun parched up their trees, or Jupiter enthroned in clouds upon the mountain top scared them with his red lightning and terrible thunder, pouring down a deluge of rain, or brightening the summits with his snow."

Nymph, among naturalists, that state of winged insects between their living in the form of a worm and their appearing in the winged or more perfect state.

The eggs of insects are first hatched into a kind of worms or maggots: which afterwards pass into the nymph state, surrounded with shells or cases of their own skins; so that, in reality, these nymphs are only the embryo insects, wrapt up in this covering; from

whence they at last get loose, though not without great difficulty.

During this nymph state the creature loses its motion. Swammerdam calls it *nympha aurelia*, or simply *aurelia*; and others give it the name of *chrysalis*, a term of the like import See the article Chrysalis.

Nymph-Band, situated about 10 leagues off the coast of the county of Waterford, and province of Munster in Ireland, is a great fishing place, and 11 leagues S. S. E. from the high head of Durgarvan. It abounds with cod, ling, skate, bream, whiting, and other fish; which was discovered by Mr Doyle, who on July 15. 1736 sailed to it, in company with seven men, on board the Nymph, a small vessel of about 12 tons. This place is well adapted for a fishing company, the great public advantages of which must be very evident.

NYMPHÆ, in *Anatomy*, two membranaceous parts, situated on each side the rima. See Anatomy *Index*.

NYMPHÆA, the Water-lily; a genus of plants belonging to the polyandria class, and in the natural method ranking under the 54th order, *Miscellaneæ*. See Botany *Index*.

Nymphæa (amongst the ancients), doubtful what structures they were; some take them to have been grottoes, deriving their name from the statues of the nymphs with which they were adorned; but that they were considerable works appears from their being executed by the emperors, (Ammian, Victor, Capitolinus) or by the city prefects. In an inscription, the term is written *nymfium*. None of all these nymphæa has lasted down to our time. Some years since, indeed, a square building of marble was discovered between Naples and Vesuvius, with only one entrance, and some steps that went down to it. On the right hand as you enter, towards the head, there is a fountain of the purest water; along which, by way of guard, as it were, is laid a naked Arethusa of the whitest marble; the bottom or ground is of variegated marble, and encompassed with a canal fed by the water from the fountain; the walls are set round with shells and pebbles of various colours; by the setting of which, as by so many strokes in a picture, are expressed the 12 months of the year, and the four political virtues; also the rape of Proserpine; Pan playing on his reed, and soothing his flock; besides the representations of nymphs swimming, sailing, and wantoning on fishes, &c.

It seems pretty evident that the nymphæa were public baths; for at the same time that they were furnished with pleasing grottoes, they were also supplied with cooling streams, by which they were rendered exceedingly delightful, and drew great numbers of people to frequent them. Silence seems to have been a particular requisite there, as appears by this inscription, *Nymphis loci, bibe, lava, tace*. That building between Naples and Vesuvius, mentioned above, was certainly one of these nymphæa.

NYMPHÆUM, (Plutarch); the name of a sacred place, near Apollonia in Illyricum, sending forth continually fire in detached streams from a green valley and verdant meadows. Dio Cassius adds, that the fire neither burns up nor parches the earth, but that herbs and trees grow and thrive near it, and therefore the place is called *nyphæum*: near which was an oracle of such a nature, that the fire, to show that the wish was granted

granted, consumed the frankincense thrown into it: but repelled it, in case the desire was rejected. It was there that a sleeping satyr was once caught and brought to Sylla as he returned from the Mithridatic war. This monster had the same features as the poets ascribe to the satyr. He was interrogated by Sylla and by his interpreters; but his articulations were unintelligible; and the Roman spurned from him a creature which seemed to partake of the nature of a beast more than that of a man.

NYMPHÆUM, in antiquity, a public hall magnificently decorated, for entertainments, &c. and where those who wanted convenience at home held their marriage feasts; whence the name.

NYMPHIDIUS, SABINUS, a person of mean descent, but appointed by Nero colleague of Tigellinus in the command of the prætorian guards. About the time, however, that the German legions revolted from this despicable prince, he was also betrayed by Nymphidius and abandoned by his guards.

Nymphidius began now to entertain thoughts of seizing the sovereignty himself. However, he did not immediately declare his ambitious views; but pretending to espouse the cause of Galba, assured the guards that Nero was fled, and promised them such sums as neither Galba nor any other was able to discharge. This promise secured for the present the empire to Galba, occasioned afterwards the loss of it, and finally, produced the destruction of Nymphidius and the guards themselves. After Nero's death, however, and on the acknowledgement of Galba as emperor, he renewed his ambition; and having, by his immense largesses, gained the affections of the prætorian guards, and persuading himself that Galba, by reason of his infirmities and old age, would never reach the capital, usurped all the authority at Rome. Presuming upon his interest, he obliged Tigellinus, who commanded, jointly with him, the prætorian guards, to resign his commission. He made several magnificent and extensive entertainments, inviting such as had been consuls or had commanded armies, distributed large sums among the people, and with shows and other diversions, which he daily exhibited, gained so great an interest with all ranks, that he already looked upon himself as sovereign. The senate, dreading his power, conferred extraordinary honours upon him, styled him their *protector*, attended him when he appeared in public, and had recourse to him for the confirmation of their degrees, as if he had been already invested with the sovereign power. This base compliance elated him to such a degree, that he usurped, not leisurely and by degrees, but all at once, an absolute authority. He acted as sovereign indeed, but he had not as yet openly declared his design of seizing the empire: his power, however, was great, and he used it in undermining Galba's power; he was, however, unsuccessful, and the disclosure of his designs was much against him. Galba was again acknowledged and proclaimed, and he, notwithstanding his artifices, detected and slain by the soldiers who were proclaiming Galba. See NERO.

NYON, a considerable town of Switzerland, in the canton of Bern, and capital of a bailiwick of the same name, with a castle. It stands delightfully upon the edge of the lake of Geneva, in the very point where it begins to widen, and in a most charming country commonly called *Pays de Vaud*. It was formerly called *Colonia Equestris Noiodunum;* and, as a proof of its antiquity, several Roman inscriptions, and other ancient remains, have been frequently discovered in the outskirts of the town. E. Long. 5. 10. N. Lat. 46. 24.

NYSA, or NYSSA, in *Ancient Geography*, a town of Ethiopia, at the south of Egypt. Some place it in Arabia. This city, with another of the same name in India, was sacred to the god Bacchus, who was educated there by the nymphs of the place, and who received the name of *Dionysus*, which seems to be compounded of Διος and Νυσα, the name of his father, and that of the place of his education. The god made this place the seat of his empire, and the capital of the conquered nations of the east. According to some geographers, there were no less than ten places of this name. One of these was famous on the coast of Eubœa, for its vines, which grew in such a uncommon manner, that if a twig was planted in the ground in the morning, it immediately produced grapes which were full ripe in the evening. A city of Thrace: another seated on the top of Mount Parnassus, and sacred to Bacchus.

NYSLOT, a strong town of Russia, in Livonia, with a castle; seated on the river Narva, among large marshes. E. Long. 26. 55. N. Lat. 58. 46.

NYSSA, a genus of plants, belonging to the polygamia class; and in the natural method ranking under the 12th order, *Holoraceæ*. See BOTANY *Index*.

NYU-CHE, or KIN, an empire which arose in Eastern Tartary in the beginning of the 13th century. From the founder of this empire the late Chinese emperor Kang-hi said that his family was descended. See CHINA and TARTARY.

O.

O, THE 14th letter and fourth vowel of our alphabet; pronounced as in the words *nose*, *rose*, &c. The sound of this letter is often so soft as to require it double, and that chiefly in the middle of words; as *goose*, *reproof*, &c. And in some words, this *oo* is pronounced like *u* short, as in *blood*, *flood*, &c.

As a numeral, O was sometimes used for 11 among the ancients; and with a dash over it thus, $\bar{o}$, for 11,000.

In the notes of the ancients, O. CON, is read *opus conductum;* O. C. Q. *opera consilioque;* O. D. M. *operæ, donum munus;* and O. LO. *opus locatum.*

O, Oak. The Greeks had two O's; viz. omicron, ο, and omega, ω; the first pronounced on the tip of the lips with a sharper sound; the second in the middle of the mouth, with a fuller sound, equal to *oo* in our language. The long and short pronunciation of our O are equivalent to the two Greek ones; the first, as in suppose; the second, as in *o*bey.

O is usually denoted long by a servile *a* subjoined, as *moan;* or by *e* at the end of the syllable, as *bone;* when these vowels are not used, it is generally short.

Among the Irish, the letter O, at the beginning of the name of a family, is a character of dignity annexed to great houses. Thus, in the history of Ireland, we frequently meet with the *O Neals*, *O Carrols*, &c. considerable houses in that island.

Camden observes, that it is the custom of the lords of Ireland to prefix an O to their names, to distinguish them from the commonalty.

The ancients used O as a mark of triple time; from a notion that the ternary, or number 3, was the most perfect of numbers, and therefore properly expressed by a circle, the most perfect of figures.

It is not, strictly speaking, the letter O, but the figure of a circle O, or double CↃ, by which the modern ancients in music used to express what they called *tempo perfecto*, or triple time. Hence the Italians call it *circolo.*

The seven antiphones, or alternate hymns of seven verses, &c. sung by the choir in the time of Advent, were formerly called *O*, from their beginning with such an exclamation.

O is an adverb of calling, or interjection of sorrow or wishing.

OAK, in *Botany*. See QUERCUS.

The oak has been long known by the title of *monarch of the woods*, and very justly. It is well known, and often very elegantly described, by the ancient poets. The following description from Virgil is exquisite:

Veluti annoso validam cùm robore quercum
Alpini Boreæ, nunc hinc, nunc flatibus illinc
Eruere inter se certant: it stridor, et alte
Consternunt terram concusso stipite frondes:
Ipsa hæret scopulis; et quantum vertice ad auras
Ætherias, tantum radice in Tartara tendit.
ÆN. iv. 441.

As o'er th' aerial Alps sublimely spread,
Some aged *oak* uprears his reverend head;
This way and that the furious tempests blow,
To lay the monarch of the mountains low;
Th' imperial plant, though nodding at the sound,
Though all his scatter'd honours strew the ground;
Safe in his strength, and seated on the rock,
In naked majesty defies the shock:
High as the head shoots tow'ring to the skies,
So deep the root in hell's foundation lies. PITT.

The ancient druids had a most profound veneration for oak trees. Pliny * says, that "the druids (as the Gauls call their magicians or wise men) held nothing so sacred as the misletoe, and the tree on which it grows, provided it be an oak. They make choice of oak groves in preference to all others, and perform no rites without oak leaves; so that they seem to have the name of druids from thence, if we derive their name from the Greek," &c. (See DRUIDS, Definition, and N° 11.) Maximus Tyrius says the Celtæ or Gauls worshipped Jupiter under the figure of a lofty oak (A).

Oak.

* Nat Hist. xvi. c. 4

This useful tree grows to such a surprising magnitude, that there were not many well authenticated instances of them in our own country, they would certainly appear difficult of belief. In the 18th volume of the Gentleman's Magazine we have the dimensions of a leaf twelve inches in length and seven in breadth, and all the leaves of the same tree were equally large. On the estate of Woodhall, purchased in 1775 by Sir Thomas Rumbold, Bart. late governor of Madras, an oak was felled which sold for 43l. and measured 24 feet round. We are also told of one in Millwood forest, near Chaddesley, which was in full verdure in winter, getting its leaves again after the autumn ones fell off. In Hunter's Evelyn's Sylva, we have an account of a very remarkable oak at Greendale; which Gough, in his edition of Camden, thus minutely describes: "The Greendale oak, with a road cut through it, still bears one green branch. Such branches as have been cut or broken off are guarded from wet by lead. The diameter of this tree at the top, whence the branches issue, is 14 feet 2 inches; at the surface of the ground 11½ feet; circumference there 35 feet; height of the trunk 53; height of the arch 10, width 6. Mr Evelyn mentions several more oaks of extraordinary size in Worksop park."

In the Gentleman's Magazine for 1773 we have an account of one differing very essentially from the common one; it is frequent about St Thomas in Devonshire, and is in that county called *Lucombe* oak, from one William Lucombe who successfully cultivated it near Exeter. It grows as straight and handsome as a fir; its leaves are evergreen, and its wood as hard as that of the common oak. Its growth is so quick, as to exceed in 20 or 30 years the altitude and girth of the common one at 100. It is cultivated in various places; Cornwall, Somersetshire, &c.

M. du Hamel du Monçeau, of the Royal Academy of Sciences at Paris (who wrote a treatise on husbandry), gave an account in the year 1749 of an oak which he had kept in water eight years, and which yielded fine leaves every spring. The tree had, he says, four or five branches; the largest 19 or 20 lines round, and more than 18 inches long. It throve more in the two first years than it would have done in the best earth; it afterwards lost its vigour, and rather decayed; which he attributed to a defect in the roots rather than to a want of aliment.

M.

(A) Camden informs us of a tradition (which, like most other traditions of this nature, seems to be founded in ignorance and fostered by credulity) respecting an oak near Malwood castle, where Rufus was killed, viz. that it budded on Christmas day, and withered before night. This tree, the same tradition reports to have been that against which Tyrrel's arrow glanced.

Oak.

M. de Buffon made some experiments on oak trees; the result of which is recorded in the Gentleman's Magazine, 1754. He had compared barked with unbarked trees, and proves, we think with success, from a variety of trials, that timber barked and dried standing, is always heavier and considerably stronger than timber kept in its bark.

The bark of oak trees was formerly thought to be extremely useful in vegetation. One load (Mr Mills in his Treatise on Husbandry informs us) of oak bark, laid in a heap and rotted, after the tanners have used it for dressing of leather, will do more service to stiff cold land, and its effects will last longer, than two loads of the richest dung; but this has been strenuously controverted. (See *Oak Leaves*).

The bark, in medicine, is also a strong astringent; and hence stands recommended in hæmorrhagies, alvine fluxes, and other preternatural or immoderate secretions; and in these it is sometimes attended with good effects. Some have alleged, that by the use of this bark every purpose can be answered which may be obtained from Peruvian bark. But after several very fair trials, we have by no means found this to be the case. Besides the bark, the buds, the acorns and their cups are used; as also the galls, which are excrescences caused by insects on the oaks of the eastern countries, of which there are divers sorts; some perfectly round and smooth, some rougher with small protuberances, but all generally having a round hole in them. All the parts of the oak are styptic, binding, and useful in all kinds of fluxes and bleedings, either inward or outward. The bark is frequently used in gargarisms, for the relaxation of the uvula, and for sore mouths and throats: it is also used in restringent clysters and injections, against the prolapsus uteri or ani. The acorns, beaten to powder, are frequently taken by the vulgar for pains in the side. The only officinal preparation is the aqua germinum quercus.

Oak Leaves. The use of oak bark in tanning, and in hot-beds, is generally known. For the latter of these purposes, however, oak leaves are now found to answer equally well, or rather better. In the notes to Dr Hunter's edition of Evelyn's Treatise on Forest Trees, we find the following directions for their use by W. Speechly: The leaves are to be raked up as soon as possible after they fall from the trees. When raked into heaps, they should immediately be carried into some place near the hot-houses, where they may lie to couch. Mr Speechly says, it was his custom to fence them round with charcoal hurdles, or any thing to keep them from being blown about the garden in windy weather. In this place they tread them well, and water them in case they happen to have been brought in dry. The heap is made six or seven feet thick, and covered over with old mats, or any thing else, to prevent the upper leaves from being blown away. In a few days the heap will come to a strong heat. For the first year or two in which he used these leaves, our author did not continue them in the heap longer than ten days or a fortnight: but by this method of management they settle so much when brought to the hot-house, that a supply was very soon required; and he afterwards found, that it was proper to let them remain five or six weeks in the heaps before they are brought to the hot-house. In getting them into the pine-pots, if they appear dry, they are to be watered, and again trodden down exceedingly well, in layers, till the pits are quite full. The whole is then covered with tan bark, to the thickness of two inches, and well trodden down, till the surface becomes smooth and even. On this the pine pots are to be placed in the manner they are to stand, beginning with the middle row first, and filling up the spaces between the pots with tan. In this manner we are to proceed to the next row, till the whole be finished; and this operation is performed in the same manner as when tan only is used. The leaves require no further trouble through the whole season; as they will retain a constant and regular heat for 12 months without stirring or turning; and our author informs us, that if he may judge from their appearance when taken out (being always entire and perfect) it is probable they would continue their heat through a second year; but, as an annual supply of leaves is easily obtained, the experiment is hardly worth making. After this, the pines will have no occasion to be moved but at stated times of their management, viz. at the shifting them in their pots, &c. when at each time a little fresh tan should be added to make up the deficiency arising from the settling of the beds; but this will be inconsiderable, as the leaves do not settle much after their long couching. During the first two years of our author's practice he did not use any tan, but plunged the pine pots into the leaves, and just covered the surface of the beds, when finished, with a little saw-dust, to give it a neatness. This method, however, was attended with one inconvenience; for, by the caking of the leaves, they shrunk from the sides of the pots, whereby they became exposed to the air, and at the same time the heat of the beds was permitted to escape.

"Many powerful reasons (says Mr Speechly) may be given why oak leaves are preferable to tanners bark.

"1. They always heat regularly; for during the whole time that I have used them, which is near seven years, I never once knew of their heating with violence; and this is so frequently the case with tan, that I affirm, and indeed it is well known to every person conversant in the management of the hot-house, that pines suffer more from this one circumstance, than all the other accidents put together, insects excepted.—When this accident happens near the time of their fruiting, the effect is soon seen in the fruit, which is exceedingly small and ill-shaped. Sometimes there will be little or no fruit at all; therefore gardeners who make use of tan only for their pines, should be most particularly careful to avoid an over-heat at that critical juncture—the time of showing the fruit.

"2. The heat of oak leaves is constant; whereas tanner's bark generally turns cold in a very short time after its furious heat is gone off. This obliges the gardener to give it frequent turnings in order to promote its heating. These frequent turnings, not to mention the expence, are attended with the worst consequences; for by the continual moving of the pots backwards and forwards, the pines are exposed to the extremes of heat and cold, whereby their growth is considerably retarded; whereas, when leaves are used, the pines will have no occasion to be moved but at the times of potting, &c. The pines have one peculiar advantage in this indisturbed situation; their roots grow through the bottoms of the pots, and mat among the leaves in a surprising manner. From the vigour of the plants when in this situation, it is highly probable that the leaves, even in this state, afford them an uncommon and agreeable nourishment.

"3. There is a saving in point of expence; which is no inconsiderable object in places where tan cannot be had but from a great distance.

"4. The last ground of preference is, that decayed leaves make good manure; whereas rotten tan is experimentally found to be of no value. I have often tried it both on sand and clay, and on wet and dry land; and never could discover in any of my experiments, that it deserved the name of a manure; whereas decayed leaves are the richest, and of all others the most proper manure for a garden. Leaves mixed with dung make excellent hot-beds; and I find that beds compounded in this manner, preserve their heat much longer than when made entirely with dung; and in both cases, the application of leaves will be a considerable saving of dung, which is a circumstance on many accounts agreeable."

Oak-Leaf Galls. These are of several kinds; the remarkable species called the *mushroom gall* is never found on any other vegetable substance but these leaves: and besides this there are a great number of other kinds.

The double gall of these leaves is very singular, because the generality of productions of this kind affect only one side of a leaf or branch, and grow all one way: whereas this kind of gall extends itself both ways, and is seen on each side of the leaf, in form of two protuberances, opposite the one to the other. These are of differently irregular shapes, but their natural figure seems that of two cones, with broad bases, and very obtuse points, though sometimes they are round, or very nearly so.

These make their first appearance on the leaf in April, and remain on it till June or longer. They are at first green, but afterwards yellowish, and are softer to the touch than many other of the productions of this kind; they are usually about the size of a large pea, but sometimes they grow to the bigness of a nut. When opened, they are found to be of that kind which are inhabited each by one insect only, and each contains one cavity. The cavity in this is, however, larger than in any other gall of the size, or even in many others of three times its size; the sides of it being very little thicker than the substance of the leaf.

It is not easy to ascertain the origin of the several species of flies which are at times seen in this manner to come out of the same species of galls. It seems the common course of nature, that only one species of insect forms one kind of gall; yet it may be, that two or three kinds may give origin to the same kind. There is, however, another occasion of our seeing different species come out of different galls of the same kind: and this is the effect of the enemies of the proper inhabitants.

It might appear that the parent fly, when she had formed a gall for the habitation of her worm offspring, had placed it in an impregnable fortress; but this is not the case; for it frequently happens, that a fly, as small perhaps as that which gave origin to the gall, produces a worm which is of the carnivorous kind, as the other feeds on vegetable juices. This little fly, well knowing that where there is one of these protuberances on a leaf, there is a tender and defenceless insect within, pierces the sides of the gall, and deposites her egg within it. This, when it hatches into a worm, feeds upon the proper inhabitant; and, finally, after devouring it, passes into the chrysalis state, and thence appears in the form of its parent fly, and is seen making its way out of the gall, in the place of the proper inhabitant.

On opening these leaf-galls, which are properly the habitation only of one animal, it is common to find two, the stronger preying upon the body of the other, and sucking its juices as it does those of the leaf: often it is found wholly employed in devouring its unoffending neighbour at once: this is probably the case when its time of eating is nearly over: and, in fine, when we find the gall inhabited by only one insect, or containing only one chrysalis, as it ought in its natural state to do, we are never certain that this is the proper inhabitant, as it may be one of these destroyers who has eaten up the other, and supplied its place. See APHIS, ENTOMOLOGY *Index*.

Oak Saw-dust is now found to answer the purposes of tanning, as well, at least, as the bark. See TANNING.

Oak of Jerusalem. See CHENOPODIUM, BOTANY *Index*.

OAKHUM, OCKHAM, or *Oakum*, in sea language, denotes the matter of old ropes untwisted and pulled out into loose hemp, in order to be used in caulking the seams, treenails, and bends of a ship, for stopping or preventing leaks.

OAKHAMPTON, a town of Devonshire, which sends two members to parliament, has 1440 inhabitants, and a manufacture of serge; situated in W. Long. 4. 5. N. Lat. 50. 48.

OANNES, a being in Chaldean mythology, represented as half a man and half a fish. According to Berosus and other fabulous writers, this monster was the civilizer of the Chaldeans; to whom he taught a system of jurisprudence so perfect as to be incapable of improvement. In discharging the duties of his office, he spent the day on dry land, but retired every night into the ocean or the river. See MYTHOLOGY, N° 25.

OAR, a long piece of timber, flat at one end and round or square at the other; and which being applied to the side of a floating vessel, serves to make it advance upon the water.

That part of the oar which is out of the vessel, and which enters into the water, is called the *blade* or *wash-plat;* and that which is within board is termed the *loom*, whose extremity being small enough to be grasped by the rowers, or persons managing the oars, is called the *handle*.

To push the boat or vessel forwards by means of this instrument, the rowers turn their backs forward, and, dipping the blade of the oar in the water, pull the handle forward so that the blade at the same time may move aft in the water: but since the blade cannot be so moved, without striking the water, this impulsion is the same as if the water were to strike the blade from the stern towards the head: the vessel is therefore necessarily moved according to this direction. Hence it follows, that she will advance with the greater rapidity, by as much as the oar strikes the water more forcibly. Thus it is evident, that an oar acts upon the side of a boat or vessel like a lever of the second class, whose fulcrum is the station upon which the oar rests on the boat's gunnel. In large vessels, this station is usually called the *row-port;* but in lighters and boats it is always termed the *row-lock*.

OARISTUS, or OARISTYS, a term in the Greek poetry, signifying a dialogue between a husband and his wife; such as that in the sixth book of the Iliad between Hector and Andromache.

Scaliger observes, that the oaristus is not properly any particular little poem, or entire piece of poetry; but always a part of a great one. He adds, that the passage now cited in Homer is the only proper oaristus extant in the ancient poets.

OASIS, the name of a fertile spot in the midst of a sandy desert. Many of those spots, or *oases*, in the African deserts are remarkable for their fertility.

OAT. See AVENA, BOTANY *Index*.

Mr Bruce gives the following account of the oats which he found growing wild in Aroossi, a small territory in Abyssinia, not far from the source of the Nile: "Wild oats (says he) grow up here spontaneously to a prodigious height and size, capable often of concealing both the horse and his rider, and some of the stalks being little less than an inch in circumference. They have, when ripe, the appearance of small canes. The inhabitants make no sort of use of this grain in any period of its growth: the uppermost thin husk of it is beautifully variegated with a changeable purple colour; the taste is perfectly good. I often made the meal into cakes in remembrance of Scotland." Our author informs us, that the Abyssinians could never be brought to relish these cakes, which they said were bitter, burnt their stomachs, and made them thirsty. He is, however, decidedly of opinion, that the wild oat of Aroossi is the oat in its original state; and that it has degenerated everywhere in Europe.

OATH, an affirmation or promise, accompanied with an invocation of God to witness what we say; and with an imprecation of his vengeance, or a renunciation of his favour, if what we affirm be false, or what we promise be not performed (A).

The laws of all civilized states have required the security of an oath for evidence given in a court of justice, and on other occasions of high importance (B); and the Christian religion utterly prohibits swearing, except when oaths are required by legal authority. Indeed no serious and reflecting theist, whether he admit the truth of revelation or not, can look upon swearing on trivial occasions as any thing else than a sin of a very heinous nature. To call upon that infinite and omnipresent Being, who created and sustains the universe, to witness all the impertinence of idle conversation, of which great part is commonly uttered at *random*, betrays a spirit so profane, that nothing short of experience could make us believe it possible for a creature endowed with reason and reflection to be habitually guilty of a practice so impious. No man can plead in extenuation of this crime, that he is tempted to swear by the importunity of any appetite or passion implanted in the human breast: for the utterance of a profane oath communicates no pleasure and removes no uneasiness: it neither elevates the speaker nor depresses the hearer.

Quakers and *Moravians*, swayed by these considerations, and by the sense which they put upon certain texts of Scripture, refuse to swear upon any occasion, even at the requisition of a magistrate, and in a court of justice. These scruples are groundless; and seem to proceed from an incapacity to distinguish between the proper use and abuse of swearing. It is unquestionably impious to call upon God to witness impertinences, or to use his tremendous name as a mere *expletive* in conversation; but it by no means follows, that we may not piously call upon him to witness truths of importance, or invoke his name with reverence and solemnity. No individual could, without gross profaneness, pray for a thousand times more wealth than he may ever have occasion to use; but it was never thought profane to pray "day by day for our daily bread, for rain from heaven, and fruitful seasons." If it be lawful to ask of God these earthly blessings, because he alone can bestow them; it cannot surely be unlawful, where the lives or properties of our

(A) The word *oath* is a corruption of the Saxon *eoth*. It is often in England called a *corporal oath*, because, in the days of popery, the person was sworn over the host or *corpus Christi*.

(B) The various oaths required by different nations at different times, and the various forms, &c. of imposing them, is a subject of very considerable extent and curiosity: An account of them does not fall within the plan of the present article; it would indeed extend it to an undue length; we cannot, however, omit observing, what is doubtless very remarkable, that the grand impostor Mahomet taught the Moslems, that their oaths might be dissolved. This wonderful doctrine is contained in the 66th chapter of the Koran; which, to free himself from his promise and oath to Hafsa his spouse, he pretended was revealed. What the use of oaths is in such circumstances, or what security they afford for performance, it is difficult to ascertain.

It is also very remarkable, that an oath respecting marriages was the cause of the first divorce at Rome. The circumstance happened about the year of the city 525, Posthumius Albinus and Spurius Carvilius being consuls. The censors of this year observing the population declining, and imagining it proceeded from interested marriages and promiscuous cohabitation, obliged all the citizens to swear, that they would not marry with any other view than that of peopling the republic. It raised, however, many scruples, and occasioned many domestic ruptures. Among the rest, one Carvilius Ruga, a man of distinction, imagined that he was bound by his oath to divorce his wife, whom he passionately loved, because she was barren, which was the first instance of a divorce at Rome from its foundation, though the marriage laws of the kings allowed it; it afterwards, however, became shamefully frequent. This is also a striking instance of the great attention paid to oaths among the Romans; it is remarked indeed by all writers, that they paid a most profound respect to them; and on that we know they founded their hopes of success in war.

Oath.

our neighbours, or the security of government is concerned, to invoke him with reverence to witness the truth of our assertions, or the sincerity of our intentions; because of our truth in many cases, and of our sincerity in all, none but he can be the witness.

The text of Scripture upon which the Quakers chiefly rest their argument for the unlawfulness of all swearing under the gospel, is our Saviour's prohibition (Mat. v. 34.): "I say unto you, swear not at all." But whoever shall take the trouble of turning over his Bible, and looking at the context, will perceive, that it is only in *ordinary conversation*, and by no means in courts of justice, that our Lord prohibits his followers from swearing at all. There is no evidence whatever, that swearing by *heaven*, by *the earth*, by *Jerusalem*, or by their own *heads*, was the form of a *judicial oath* in use among the Jews. On the contrary, we are told by *Maimonides* *, that "if any man swear by heaven or by earth, yet this is not an oath;" which surely he could not have said, had such been the forms of judicial swearing. Indeed they could not have admitted such forms into their courts without expressly violating the law of Moses, who commands them to "Fear the Lord (JEHOVAH) their God, to serve him, and to swear by his NAME." But the Jews, as every one knows, had such a reverence for the name *Jehovah*, that they would not pronounce it on slight occasions, and therefore could not swear by that name in common conversation. Hence, to gratify their propensity to common swearing, they invented such oaths as, by *heaven*, by *earth*, by *Jerusalem*, by *the life of thy head*, &c. and by this contrivance they thought to avoid the guilt of profaning the name JEHOVAH. These, however, being appeals to insensible objects, either had no meaning, or were in fact, as our Saviour justly argues, oaths by that God whose creatures they were; so that the Jew who swore them was still guilty of profaneness towards the very JEHOVAH whose name his superstition would not permit him to pronounce. But what puts it beyond all doubt that the use of judicial oaths is not wholly prohibited in the gospel, is the conduct of our Saviour himself as well as of his apostle St Paul. When Jesus was simply *asked* by the high priests, what it was which certain false witnesses testified against him? we are told by the evangelists, that "he held his peace:" but being *adjured* by the living God to declare whether he was the Christ, the Son of God, or not, he immediately answered the high priest, without objecting to the *oath* (for such it was) upon which he was examined. "St Paul, in his Epistle to the Romans †, says, '*God is my witness*, that, without ceasing, I make mention of you in my prayers;' and to the Corinthians, still more strongly, '*I call God for a record upon my soul*, that, to spare you, I came not as yet to *Corinth*.' Both these expressions are of the nature of oaths; and the author of the Epistle to the Hebrews speaks of the custom of swearing judicially without any mark of censure or disapprobation: 'Men verily swear by the greater; and an oath, for confirmation, is to them an end of all strife."

* See *Whitby on the Place.*

† *Paley's Moral Philosophy.*

But though a nation has an undoubted right to require the security of an oath upon occasions of real importance, we do not hesitate to say, that, in our opinion, it is something worse than bad policy to multiply oaths, and to hold out to the people temptations to perjure themselves. The security which an oath affords, depends entirely upon the reverence which attaches to it in the mind of him by whom it is given; but that reverence is much weakened by the frequency of oaths, and by the careless manner in which they are too often administered. An excellent moralist ‡ observes, with truth, that "the levity and frequency with which oaths are administered, has brought about a general inadvertency to the obligation of them, which both in a religious and political view is much to be lamented; and it merits (continues he) public consideration, whether the requiring of oaths on so many frivolous occasions, especially in the customs, and in the qualification for petty offices, has any other effect than to make them cheap in the minds of the people. A pound of tea cannot travel regularly from the ship to the consumer without costing *half a dozen oaths* at least; and the same security for the due discharge of his office, namely that of an oath, is required from a *church warden* and an *archbishop*, from a *petty constable* and the *chief justice* of England. Let the law continue its own sanctions, if they be thought requisite; but let it spare the solemnity of an oath: and where it is necessary, from the want of something better to depend upon, to accept a man's own word or own account, let it annex to prevarication penalities proportioned to the public consequence of the offence."

‡ *M[...] [...]ley.*

That these pernicious consequences of frequent oaths are not felt only in England, we have the evidence of another respectable writer, whose acuteness well qualified him to observe, whilst his station in society furnished him with the best opportunities of observing, the effects of repeated swearing upon the morals of Scotchmen. "Customhouse oaths (says Lord Kames §) have become so familiar among us, as to be swallowed without a wry face; and is it certain that bribery and perjury in electing parliament members are not approaching to the same cool state? men creep on to vice by degrees. Perjury, in order to support a friend, has become customary of late years; witness fictitious qualifications in the electors of parliament-men, which are made effectual by perjury: yet such is the degeneracy of the present time, that no man is the worse thought of upon that account. We must not flatter ourselves, that the poison will reach no farther: a man who boggles not at perjury to serve a friend, will in time become such an adept, as to commit perjury in order to ruin a friend when he becomes an enemy."

§ *S[...] of t[...] tory [...] Ma[...]*

Besides the frequency of oaths, we have mentioned the irreverent manner in which they are too often administered as one of the causes which make them cheap in the estimation of the people. In this view, the *form* of the oath, and the *ceremonies* with which it is required to be taken, are of considerable importance. "The forms of oaths in Christian countries (says Mr Paley) are very different; but in none I believe worse contrived either to convey the meaning or to impress the obligation of an oath, than in England. In that country the juror, after repeating the promise or affirmation which the oath is intended to confirm, adds, 'so help me God;' or more frequently the substance of the oath is repeated to the juror by the officer or magistrate who administers it; adding in the conclusion, 'so help you God.' The energy of the sentence resides in the particle

Oath.

particle *so: so*, i. e. *hac lege* 'upon condition of my speaking the truth, or performing this promise, may God help me, and not otherwise.' The juror, whilst he hears or repeats the words of the oath, holds his right hand upon a Bible, or other book containing the four gospels. The conclusion of the oath sometimes runs, '*ita me Deus adjuvet, et hæc sancta evangelia*,' or 'so help me God, and the contents of this book;' which last clause forms a connexion between the words and action of the juror, which before was wanting. The juror then kisses the book."

This obscure and elliptical form, the excellent author justly observes, is ill calculated to impress the juror with reverence: and he seems to think great preference due to the form of judicial oaths in Scotland. In that country the juror holds up his right hand towards heaven, and swears by Almighty God, and as he shall answer to God at the great day of judgment, "that he will tell the truth, the whole truth, and nothing but the truth, so far as he knows, or it shall be asked of him." This, if administered with dignity and reverence, is an oath sufficiently solemn and well calculated to have the proper effect upon the mind of the juror, as it brings immediately into his view the Author of his being, and the awful day of final retribution when every man shall receive the things done in his body according to that he hath done, whether it be good or evil. But when the magistrate, as is too often the case, repeats this solemn invocation without rising from his seat at the name of the Supreme Being, and in a tone of carelessness which may convey to the ignorant juror an opinion that he has himself no serious belief that there ever will be a great day of judgment, the form, however excellent, makes not its full impression.

But let us suppose the oath to be administered with the greatest dignity and reverence, the words of the promise itself appear to us by no means unexceptionable. In a trial on life and death, we should be glad to know what this oath binds the witness to declare. Is he to tell *all that he knows* touching the matter in question? or only all that shall be *asked* of him? If he be obliged, in virtue of his oath, to tell all that he knows, the clause—"or it shall be asked of you" is superfluous, and calculated to mislead. If he be bound to tell nothing more of the truth than what shall be asked of him, the word *or* should be changed into *and;* he should swear "to tell the truth, &c. so far as he knows, *and* it shall be asked of him." The court, we believe, considers the witness as bound to declare every thing which he knows touching the matter in question. The greater part of witnesses, on the other hand, consider themselves as bound no farther by their oath than to give true answers to such questions as shall be asked of them. They would do well, however, to remember, that as oaths are designed for the security of the *public*, they must be interpreted in the sense in which the public intends them, otherwise they afford no security. But the sense of the public is the law; and as it belongs to the court to declare what the mind of the law is, the witness, who has any doubt concerning the extent of the obligation imposed on him by the words of this oath, should apply to the court for a solution of that doubt, which will be a safe guide to him respecting the evidence which he is to give. Should the court, in resolving the doubts of a witness, give an opinion concerning the sense of any other part of the oath contrary to what he apprehends to be the design of the law in imposing it, he is bound to disregard such opinion; because it is only where he himself is doubtful that the court has a right to interfere, and because in all moral questions men must be finally determined by their own judgment and conscience.

There is one case, and but one, in which, whatever sense be put upon the words of the oath, no witness is obliged to declare the *whole* truth. It is when such declaration would tend to acuse himself of some legal crime; for as the laws of Scotland and England constrain no man to become his own accuser, they must be considered as imposing the oath of testimony with this tacit reservation. "The exception, however *, must be confined to *legal* crimes. A point of honour, of delicacy, or of reputation, may make a witness backward to disclose some circumstance with which he is acquainted; but is no excuse for concealment, unless it could be shown, that the law which imposes the oath, intended to allow this indulgence to such motives. The exception is also withdrawn by compact between the magistrate and the witness, when an accomplice is admitted to give evidence against the partners of his crime. But these are a sort of witnesses to whom a sensible jury will always listen with a very cautious ear.

* *Paley's Moral Philosophy.*

Oaths are either *assertory* or *promissory*. Assertory oaths are required both to confirm our veracity in evidence, and to give security to the public that we *believe* certain propositions conceived to be of public importance. An oath in *evidence* binds the juror to declare what he *knows* to be true, and nothing *but* what he knows to be true. An oath required to assure the public of our *belief* in the *truth* of any proposition, cannot, without the guilt of perjury, be taken by any man, who, at the time of swearing, has the slightest doubt whether the proposition be really true. Such an oath, however, though it unquestionably requires the sincerity of the juror's belief at the time when it is given, cannot oblige him to continue in that belief as long as he may live; for belief is not in any man's power: it is the necessary consequence of evidence, which *compels* the assent of the mind according as it appears to preponderate on the one side or on the other. No man, therefore, can be justly accused of perjury for holding opinions contrary to those which he may formerly have sworn to believe; because his belief at the time of emitting his oath may have been the necessary result of the evidence which then appeared before him; and his change of opinion may have resulted with the same necessity from superior evidence which had been since thrown into the opposite scale, and made it preponderate. On this account, we cannot help thinking, that all assertory oaths, except such as are necessary to confirm testimony respecting *facts*, ought either to be abolished or expressed with great caution. Of truths intuitively certain or capable of rigid demonstration, no man of common sense can entertain a doubt; and therefore the public never requires from individuals the solemnity of an oath as an assurance of their believing such truths. But with respect to the truth of propositions which admit of nothing superior to moral evidence on either side, a man of the most steady

steady virtue may think differently at different periods of his life; and in such cases, the effect of an oath, if it have any effect, can only be either, to shut the man's eyes against the light, or to make his integrity be causelessly questioned by those who shall observe his change of belief.

Promissory oaths cannot, without the guilt of perjury, be given by him, who, at the time of swearing, knows that it will not be in his power to fulfil the promise, or who does not seriously intend to fulfil it. A promissory oath cannot, without great guilt, be given by any man, who at the time of swearing believes the object of the promise to be in itself unlawful; for if he seriously mean to fulfil his oath, he calls upon Almighty God to witness his intention to commit a crime. Promissory oaths give to the public greater security than a simple promise; because the juror having the thoughts of God and of religion more upon his mind at the one time than at the other, offends with a higher hand, and in more open contempt of the divine power, knowledge, and justice, when he violates an oath, than when he breaks a promise. Yet it is certain that promissory oaths, though more solemn and sacred, cannot be binding, when the promise without an oath would not be so in an inferior degree; for the several cases of which, see PROMISE and ALLEGIANCE.

Coronation OATH. See KING.

OATHLAW, the name of a parish in Angus, about two miles from Forfar, chiefly remarkable for the remains of a Roman camp called *Battle-dykes* (vulgarly *Black-dykes*), which is about a mile west of the church.

OBADIAH, or the *Prophecy* of OBADIAH, a canonical book of the Old Testament, which is contained in one single chapter; and is partly an invective against the cruelty of the Edomites, who mocked and derided the children of Israel as they passed into captivity; and with other enemies, their confederates, invaded and oppressed those strangers, and divided the spoil amongst themselves; and partly a prediction of the deliverance of Israel, and of the victory and triumph of the whole church over her enemies.

OBADIAH, the prophet, is believed to have been the same with the governor of Ahab's house, mentioned in the first book of Kings, (xviii. 3, &c.) who hid and fed the hundred prophets whom Jezebel would have destroyed; and some say, that he was that Obadiah whom Josiah made overseer of the works of the temple, (2 Chron. xxxiv. 12.). The truth is, that when he lived or prophesied is wholly uncertain: though most writers make him cotemporary with Hosea, Amos, and Joel.

OBADIAH, a valiant man of David's army, who came to join him in the wilderness, with several others of the tribe of Gad, (1 Chron. xii. 9.).

This was also the name of one of those whom King Jehoshaphat sent into the cities of Judah to instruct the people in their religion, (2 Chron. xvii. 7.). It was also the name of one of the principal men of Judah, who signed the covenant that Nehemiah renewed with the Lord, (Nehem. x. 5.).

OBED-EDOM, son of Jeduthun, a Levite, (1 Chr. xvi. 38.) and father of Shemaiah, Jehozabad, Joah, Sacar, Nathaneel, Ammiel, Issachar, and Peulthai. He had a numerous family, says the Scripture, (1 Chron.

xxvi. 4.) because the Lord blessed him; and this is the occasion of the blessing. When David transferred the ark of the covenant to the city of Jerusalem, Uzzah having rashly laid hands on the ark, which he thought to be in danger of falling, was smitten of God, and died upon the spot. David, terrified at this accident, durst not remove the ark into the place he had provided for it in his own house, but set it up in the house of Obed-edom, which was near the place where Uzzah had been struck dead. But the presence of the ark not only created no temporal misfortune to the family of this Levite, but, on the contrary, the Lord heaped upon him all sorts of blessings; which encouraged David some months after to remove it to the place he had appointed for it. Afterwards Obed-edom and his sons were assigned to be keepers of the doors of the temple, (1 Chron. xv. 18, 21.). In the second book of Samuel, (vi. 10.) Obed-edom is called the Gittite, probably because he was of Gathrimmon, a city of the Levites beyond Jordan, (Josh. xxi. 24, 25.).

OBELISK, in *Architecture*, a truncated, quadrangular, and slender pyramid, raised as an ornament, and frequently charged either with inscriptions or hieroglyphics.

Obelisks appear to be of very great antiquity, and to have been first raised to transmit to posterity precepts of philosophy, which were cut in hieroglyphical characters: afterwards they were used to immortalize the great actions of heroes, and the memory of persons beloved. The first obelisk mentioned in history was that of Ramases king of Egypt, in the time of the Trojan war, which was 40 cubits high. Phius, another king of Egypt, raised one of 55 cubits; and Ptolemy Philadelphus, another of 88 cubits, in memory of Arsinoe. Augustus erected one at Rome in the Campus Martius, which served to mark the hours on a horizontal dial, drawn on the pavement. They were called by the Egyptian priests the *fingers of the sun*, because they were made in Egypt also to serve as styles or gnomons to marks the hours on the ground. The Arabs still call them *Pharaoh's needles*; whence the Italians call them *aguglia*, and the French *aiguilles*.

The famous obelisks called the *devil's arrows*, now reduced to three, the fourth having been taken down in the last century, stand about half a mile from the town of Borough-Bridge to the south-west, in three fields, separated by a lane, 200 feet asunder nearly, on high ground sloping every way. Mr Drake urges many arguments for their Roman antiquity, and plainly proves them to be natural, and brought from Plumton quarries about five miles off, or from Ickly 16 miles off. The cross in the town, 12 feet high, is of the same kind of stone. The eastermost or highest is 22 feet and a half high by 4 broad, and $14\frac{1}{2}$ in girth; the second $21\frac{1}{2}$ by $55\frac{1}{2}$; the third $16\frac{1}{2}$ by 84. Stukeley's measures differ. The flutings are cut in the stone but not through: the tallest stands alone, and leans to the south. Plot and Stukeley affirm them to be British monuments, originally hewn square. Dr Gale supposed that they were Mercuries, which have lost their heads and inscriptions; but in a MS. note in his Antoninus, he acknowledges that he was misinformed, and that there was no cavity to receive a bust.

On the north side of Penrith, in the churchyard, are two square obelisks, of a single stone each, 11 or 12 feet high,

high, about 12 inches diameter, and 12 by 8 at the sides, the highest about 18 inches diameter, with something like a transverse piece to each, and mortised into round base. They are 14 feet asunder, and between them is a grave enclosed between four semicircular stones of the unequal lengths of five, six, and four and a half, and two feet high, having on the outsides rude carving, and the tops notched. This is called the *Giant's grave*, and ascribed to Sir Ewen Cæsarius, who is said to have been as tall as one of the columns, and capable of stretching his arms from one to the other; to have destroyed robbers and wild boars in Englewood forest; and to have had a hermitage hereabouts called *Sir Hugh's parlour*; but the conjectures respecting them are extremely various and contradictory. A little to the west of these is a stone called the *Giant's Thumb*, six feet high, 14 inches at the base contracted to 10, which is no more than a rude cross, such as is at Longtown in Cumberland, and elsewhere; the circle of the cross 18 inches diameter.

Near the town of Forres in the north of Scotland there is a very fine obelisk, 22 feet in height, known by the name of the *Forres pillar*, or *Sweno's stone*. See Forres.

M. Pouchard, in the memoirs of the Academy of Inscriptions, gives a curious account of some celebrated Egyptian obelisks. See Gentleman's Magazine for June 1748.

OBJECT, in *Philosophy*, something apprehended or presented to the mind by sensation or imagination. See Metaphysics, Part I. Chap. I. Sect II.

Object-Glass of a Telescope, or *Microscope*, the glass placed at the end of the tube which is next the object. See Optics and Microscope.

OBJECTION, something urged to overthrow a position, or a difficulty raised against an allegation or proposition of a person we are disputing with.

OBJECTIVE, is used in the schools, in speaking of a thing which exists no otherwise than as an object known. The existence of such a thing is said to be objective.

OBIT, (Lat.) signifies a funeral solemnity, or office for the dead, most commonly performed when the corpse lies in the church uninterred: Also the anniversary office, (2 Cro. 51 Dyer 313.). The anniversary of any person's death was called the *obit*; and to observe such day with prayers and alms, or other commemoration, was the keeping of the obit. In religious houses they had a register, wherein they entered the obits or obitual days of their founders and benefactors; which was thence termed the *obituary*. The tenure of obit or chantry lands is taken away and extinct by 1 Edw. VI. c. 14. and 15 Car. II. c. 9.

OBLATE, flattened or shortened; as an oblate spheroid, having its axis shorter than its middle diameter; being formed by the rotation of an ellipse about the shorter axis. The earth, whose polar diameter is shorter than the equatorial, is an oblate spheroid.

OBLATI, in church history, were secular persons, who devoted themselves and their estates to some monastery, into which they were admitted as a kind of lay brothers. The form of their admission was putting the bell ropes of the church round their necks, as a mark of servitude. They wore a religious habit, but different from that of the monks.

OBLIGATION, in general, denotes any act whereby a person becomes bound to another to do something; as to pay a sum of money, be surety, or the like.

Obligations are of three kinds, viz. natural, civil, and mixed. Natural obligations are entirely founded on natural equity; civil obligations on civil authority alone, without any foundation in natural equity; and mixed obligations are those which, being founded on natural equity, are farther enforced by civil authority.

In a legal sense, obligation signifies a bond, wherein is contained a penalty, with a condition annexed, for the payment of money, &c. The difference between it and a bill is, that the latter is generally without a penalty or condition, though it may be made obligatory: and obligations are sometimes by matter of record, as statutes and recognizances. See the article Bond.

Moral Obligation. See Moral Philosophy, N° 58, &c.

OBLIQUE, in *Geometry*, something aslant, or that deviates from the perpendicular. Thus an oblique angle is either an acute or obtuse one, i. e. any angle except a right one.

Oblique Cases, in *Grammar*, are all the cases except the nominative. See Grammar.

Oblique Ascension, is that point of the equinoctial which rises with the centre of the sun, or star, or any other point of the heavens, in an oblique sphere.

Oblique Circle, in the stereographic projection, is any circle that is oblique to the plane of projection.

Oblique Descension, that point of the equinoctial which sets with the centre of the sun, or star, or any other point of the heavens, in an oblique sphere.

Oblique Line, that which, falling on another line, makes oblique angles with it, viz. one acute, and the other obtuse.

Oblique Planes, in *Dialling*, are those which decline from the zenith, or incline towards the horizon. See Dial.

Oblique Sailing, in *Navigation*, is when a ship sails upon some rhumb between the four cardinal points, making an oblique angle with the meridian; in which case she continually changes both latitude and longitude. See Navigation, Chap. VIII.

OBLIQUUS, in *Anatomy*, a name given to several muscles, particularly in the head, eyes, and abdomen. See Anatomy, *Table of the Muscles*.

OBLONG, in general, denotes a figure that is longer than broad; such is a parallelogram.

OBOLARIA, a genus of plants belonging to the didynamia class; and in the natural method ranking under the 40th order, *Personatæ*. See Botany *Index*.

OBOLUS, an ancient silver money of Athens, the sixth part of a drachma; worth somewhat more than a penny farthing sterling.—The word comes from the Greek οβελος, or οβιλος, "spit, or broach;" either because it bore such an impression; or because, according to Eustathius, it was in form thereof. But those now in the cabinets of the antiquaries are round.

Obolus, in *Medicine*, is used for a weight of ten grains, or half a scruple.

OBOTH, an encampment of the Hebrews in the wilderness. From Punon they went to Oboth, and from Oboth to Ije-abarim, (Num. xxi. 10. xxxiii. 43).

Ptolemy speaks of a city called Oboda, or Eboda, in Arabia Petræa, which is the same as Oboth. Pliny and the geographer Stephanus mention it also. Stephanus makes it belong to the Nabathæans, and Pliny to the Helmodeans, a people of Arabia. It was at Oboth that they worshipped the god Obodus, which Tertullian joins with Dusares, another god or king of this country.

OBREPTITIOUS, an appellation given to letters patent, or other instruments, obtained of a superior by surprise, or by concealing from him the truth.

OBSCURE, something that is dark and reflects little light in material objects, or that is not clear and intelligible in the objects of the intellect.

OBSECRATION, in *Rhetoric*, a figure whereby the orator implores the assistance of God or man.

OBSEQUIES, the same with funeral solemnities. See FUNERAL.

OBSERVATION, among navigators, signifies the taking the sun's or the stars meridian altitude, in order thereby to find the latitude.

OBSERVATORY, a place destined for observing the heavenly bodies; being generally a building erected on some eminence, covered with a terrace for making astronomical observations.

The more celebrated observatories are, 1. The Greenwich observatory, built in 1676, by order of Charles II. at the solicitation of Sir Jonas Moore and Sir Christopher Wren; and furnished with the most accurate instruments; particularly a noble sextant of seven feet radius, with telescopic sights.

2. The Paris observatory, built by the order of Louis XIV. in the fauxbourg St Jacques.

It is a very singular, and a very magnificent building, the design of Monsieur Perault: it is 80 feet high; and has a terrace at the top.

The difference in longitude between this and the Greenwich observatory is 2° 20′.

In it is a cave or cellar, of 170 feet descent, for experiments that are to be made far from the sun, &c. particularly such as relate to congelations, refrigerations, indurations, conservations, &c.

3. Tycho Brahe's observatory, which was in the little island Ween, or Scarlet Island, between the coasts of Schonen and Zealand in the Baltic. It was erected and furnished with instruments at his own expence, and called by him *Uraniburg*. Here he spent twenty years in observing the stars; the result is his catalogue.

4. Pekin observatory. Father Le Compte describes a very magnificent observatory, erected and furnished by the late emperor of China, in his capital, at the intercession of some Jesuit missionaries, principally Father Verbeist, whom he made his chief observer. The instruments are exceedingly large; but the division less accurate, and the contrivance in some respects less commodious, than that of the Europeans. The chief are, An armillary zodiacal sphere of six feet diameter; an equinoctial sphere of six feet diameter; an azimuthal horizon of six feet diameter; a large quadrant six feet radius; a sextant eight feet radius; and a celestial globe six feet diameter.

Observatories, as they are very useful, and indeed absolutely necessary for astronomers, so they have become far more common than they were. There is a very excellent one now at Oxford, built by the trustees of Dr Radcliffe, at the expence of nearly 30,000l. At Cambridge there is as yet no public observatory. Over the great gate of Trinity college, indeed, there is one which is called *Sir Isaac Newton's*, because this great philosopher had used it; but it is gone to decay. It were well if the university would repair and preserve it in memory of that truly great man. In St John's, too, there is a small one. The late ingenious Mr Cotes had used to give lectures in Sir Isaac Newton's on experimental philosophy. In Scotland there is an observatory at Glasgow belonging to the university: there is one erected on the Calton hill at Edinburgh; but it is in very bad repair (see EDINBURGH); and there is an excellent one at Dublin.

Plate CCCLXX.

5. Bramins observatory at Benares. Of this Sir Robert Barker gives the following account (Phil. Trans. vol. lxvii. p. 598.). "Benares in the East Indies, one of the principal seminaries of the Bramins or priests of the original Gentoos of Hindostan, continues still to be the place of resort of that sect of people; and there are many public charities, hospitals, and pagodas, where some thousands of them now reside. Having frequently heard that the ancient Bramins had a knowledge of astronomy, and being confirmed in this by their information of an approaching eclipse both of the sun and moon, I made inquiry, when at that place in the year 1772, among the principal Bramins, to endeavour to get some information relative to the manner in which they were acquainted with an approaching eclipse. The most intelligent that I could meet with, however, gave me but little satisfaction. I was told that these matters were confined to a few, who were in possession of certain books and records; some containing the mysteries of their religion; and others the tables of astronomical observations, written in the Shanscrit language, which few understood but themselves: that they would take me to a place which had been constructed for the purpose of making such observations as I was inquiring after, and from whence they supposed the learned Bramins made theirs. I was then conducted to an ancient building of stone, the lower part of which, in its present situation, was converted into a stable for horses, and a receptacle for lumber; but by the number of court-yards and apartments, it appeared that it must once have been an edifice for the use of some public body of people. We entered this building, and went up a staircase to the top of a part of it, near to the river Ganges, that led to a large terrace, where, to my surprise and satisfaction, I saw a number of instruments yet remaining, in the greatest preservation, stupendously large, immoveable from the spot, and built of stone, some of them being upwards of 20 feet in height; and although they are said to have been erected 200 years ago, the graduations and divisions on the several arcs appeared as well cut, and as accurately divided, as if they had been the performance of a modern artist. The execution in the construction of these instruments exhibited a mathematical exactness in the fixing, bearing, fitting of the several parts, in the necessary and sufficient supports to the very large stones that composed them, and in the joining and fastening each into the other by means of lead and iron.

"The situation of the two large quadrants of the instrument marked A in the plate, whose radius is nine feet two inches, by their being at right angles with a

gnomon

gnomon at twenty-five degrees elevation, are thrown into such an oblique situation as to render them the most difficult, not only to construct of such a magnitude, but to secure in their position for so long a period, and affords a striking instance of the ability of the architect in their construction: for by the shadow of the gnomon thrown on the quadrants, they do not appear to have altered in the least from their original position; and so true is the line of the gnomon, that, by applying the eye to a small iron ring of an inch diameter at one end, the sight is carried through three others of the same dimension, to the extremity at the other end, distant 38 feet 8 inches, without obstruction; such is the firmness and art with which this instrument has been executed. This performance is the more wonderful and extraordinary, when compared with the works of the artificers of Hindostan at this day, who are not under the immediate direction of an European mechanic; but arts appear to have declined equally with science in the east.

"Lieutenant Colonel Archibald Campbell, at that time chief engineer in the East India Company's service at Bengal, made a perspective drawing of the whole of the apparatus that could be brought within his eye at one view; but I lament he could not represent some very large quadrants, whose radii were about 20 feet, they being on the side from whence he took his drawing. Their description, however, is, that they are exact quarters of circles of different radii, the largest of which I judged to be 20 feet, constructed very exactly on the sides of stone walls, built perpendicular, and situated, I suppose, in the meridian of the place: a brass pin is fixed at the centre or angle of the quadrant, from whence, the Bramin informed me, they stretched a wire to the circumference when an observation was to be made; from which, it occurred to me, the observer must have moved his eye up or down the circumference, by means of a ladder or some such contrivance, to raise and lower himself, until he had discovered the altitude of any of the heavenly bodies in their passage over the meridian, so expressed on the arcs of these quadrants: these arcs were very exactly divided into nine large sections; each of which again into ten, making ninety lesser divisions or degrees; and those also into twenty, expressing three minutes each, of about two-tenths of an inch asunder; so that it is probable they had some method of dividing even these into more minute divisions at the time of observation.

"My time would only permit me to take down the particular dimensions of the most capital instrument, or the greater equinoctial sun-dial, represented by figure A, which appears to be an instrument to express solar time by the shadow of a gnomon upon two quadrants, one situated to the east, and the other to the west of it; and indeed the chief part of their instruments at this place appear to be constructed for the same purpose, except the quadrants, and a brass instrument that will be described hereafter.

"Figure B is another instrument for the purpose of determining the exact hour of the day by the shadow of a gnomon, which stands perpendicular to, and in the centre of, a flat circular stone, supported in an oblique situation by means of four upright stones and a cross piece; so that the shadow of the gnomon, which is a perpendicular iron rod, is thrown upon the division of the circle described on the face of the flat circular stone.

"Figure C is a brass circle, about two feet diameter, moving vertically upon two pivots between two stone pillars, having an index or hand turning round horizontally on the centre of this circle, which is divided into 360 parts; but there are no counter divisions on the index to subdivide those on the circle. This instrument appears to be made for taking the angle of a star at setting or rising, or for taking the azimuth or amplitude of the sun at rising or setting.

"The use of the instrument, figure D, I was at a loss to account for. It consists of two circular walls; the outer of which is about forty feet diameter, and eight feet high; the wall within about half that height, and appears intended for a place to stand on to observe the divisions on the upper circle of the outer wall, rather than for any other purpose; and yet both circles are divided into 360 degrees, each degree being subdivided into twenty lesser divisions, the same as the quadrants. There is a door-way to pass into the inner circle, and a pillar in the centre, of the same height with the lower circle, having a hole in it, being the centre of both circles, and seems to be a socket for an iron rod to be placed perpendicular into it. The divisions on these, as well as all the other instruments, will bear a nice examination with a pair of compasses.

"Figure E is a smaller equinoctial sun dial, constructed upon the same principle as the larger one A.

"I cannot quit this subject without observing, that the Bramins, without the assistance of optical glasses, had nevertheless an advantage unexperienced by the observers of the more northern climates. The serenity and clearness of the atmosphere in the night-time in the East Indies, except at the seasons of the monsoons or periodical winds changing, is difficult to express to those who have not seen it, because we have nothing in comparison to form our ideas upon: it is clear to perfection, a total quietude subsists, scarcely a cloud to be seen, and the light of the heavens, by the numerous appearance of the stars, affords a prospect both of wonder and contemplation.

"This observatory at Benares is said to have been built by the order of the emperor Ackbar: for as this wise prince endeavoured to improve the arts, so he wished also to recover the sciences of Hindostan, and therefore directed that three such places should be erected; one at Delhi, another at Agra, and the third at Benares."

OBSIDIANUS LAPIS, or OBSIDIAN, a mineral substance. See MINERALOGY *Index*.

OBSIDIONALIS, an epithet applied by the Romans to a sort of crown. See the article CROWN.

OBSTETRICS, or the OBSTETRIC ART, the same with MIDWIFERY.

OBSTRUCTION, in *Medicine*, such an obturation of the vessels as prevents the circulation of the fluids, whether of the sound and vital, or of the morbid and peccant kind, through them.

OBTURATOR. See ANATOMY, *Table of the Muscles*.

OBTUSE, signifies blunt, dull, &c. in opposition to acute or sharp. Thus we say, obtuse angle, obtuse-angled triangle, &c.

Oby || Occupancy.

OBY, or OB, a large and famous river of Asiatic Russia, which issues from the Altin lake (called by the Russians *Teleskoi Osero*), in latitude 52 degrees, and longitude 97 degrees. Its name signifies *Great;* and accordingly in Russia it is often styled the *Great River*. The Calmucks and Tartars call it *Umar*. Its stream is very large and smooth, its current being usually slow; and it is in general between two and three hundred fathoms broad; though in some places it is much wider, It affords plenty of fish, and is navigable almost to the lake from which it springs. After a long winding course through a vast tract of land, in which it forms several islands, it empties itself in latitude 67 degrees, and longitude 86 degrees, into a bay, which, extending near 400 miles farther, joins the Icy sea, in latitude 73. 30. and longitude 90. The springs from which this river rises, are not very copious: but it receives in its course the waters of a great number of considerable streams. Of these, the Tom and the Irtis are the most considerable: the Tom falls into it in latitude 58. and the Irtis in latitude 61. and longitude 86. The exact course of this river was unknown till the country was surveyed by the Russians: who have given us tolerable maps of it and of all Siberia. The Oby is the first great river eastward of the Oural mountains which bound Europe, and its course is upwards of 2000 miles in length.

OCCIDENT, in *Geography*, the westward quarter of the horizon; or that part of the horizon where the ecliptic, or the sun therein, descends into the lower hemisphere; in contradistinction to *orient*. Hence we use the word *occidental* for any thing belonging to the west; as occidental bezoar, occidental pearl, &c.

OCCIDENT *Estival*, that point of the horizon where the sun sets at midwinter, when entering the sign Capricorn.

OCCIDENT *Equinoctial*, that point of the horizon where the sun sets, when he crosses the equinoctial, or enters the sign Aries or Libra.

OCCIPITAL, in *Anatomy*, a term applied to the parts of the occiput, or back part of the skull.

OCCULT, something hidden, secret, or invisible. The occult sciences are magic, necromancy, cabbala, &c. Occult qualities, in philosophy, were those qualities of body or spirit which baffled the investigation of philosophers, and for which they were unable to give any reason; unwilling, however, to acknowledge their ignorance, they deceived themselves and the vulgar by an empty title, calling what they did not know *occult*.

OCCULT, in *Geometry*, is used for a line that is scarce perceivable, drawn with the point of the compasses or a leaden pencil. These lines are used in several operations, as the raising of plans, designs of building, pieces of perspective, &c. They are to be effaced when the work is finished.

OCCULTATION, in *Astronomy*, the time a star or planet is hid from our sight, by the interposition of the body of the moon or some other planet.

Blackst. Comment.

OCCUPANCY, in *Law*, is the taking possession of those things which before belonged to nobody. This is the true ground and foundation of all PROPERTY, or of holding those things in severalty, which by the law of nature, unqualified by that of society, were common to all mankind. But, when once it was agreed that every thing capable of ownership should have an owner, natural reason suggested, that he who could first declare his intention of appropriating any thing to his use, and, in consequence of such his intention, actually took it into possession, should thereby gain the absolute property of it; according to that rule of the law of nations, recognized by the laws of Rome, *Quod nullius est, id ratione naturali occupanti conceditur.*

This right of occupancy, so far as it concerns real property, hath been confined by the laws of England within a very narrow compass; and was extended only to a single instance; namely, where a man was tenant *pour autre vie*, or had an estate granted to himself only (without mentioning his heirs) for the life of another man, and died during the life of *cestuy que vie*, or him by whose life it was holden: in this case he that could first enter on the land, might lawfully retain the possession so long as *cestuy que vie* lived, by right of occupancy.

This seems to have been recurring to first principles, and calling in the law of nature to ascertain the property of the land, when left without a legal owner. For it did not revert to the granter, who had parted with all his interest, so long as *cestuy que vie* lived; it did not escheat to the lord of the fee; for all escheats must be of the absolute entire fee, and not of any particular estate carved out of it, much less of so minute a remnant as this: it did not belong to the grantee; for he was dead: it did not descend to his heirs; for there were no words of inheritance in the grant: nor could it vest in his executors; for no executors could succeed to a freehold. Belonging therefore to nobody, like the *hæreditas jacens* of the Romans, the law left it open to be seized and appropriated by the first person that could enter upon it, during the life of *cestuy que vie*, under the name of an occupant. But there was no right of occupancy allowed, where the king had the reversion of the lands: for the reversioner hath an equal right with any other man to enter upon the vacant possession; and where the king's title and a subject's interfere, the king's shall always be preferred. Against the king therefore there could be no prior occupant, because *nullum tempus occurrit regi*. And, even in the case of a subject, had the estate *pour autre vie* granted to a man *and his heirs* during the life of *cestuy que vie*, there the heir might, and still may enter and hold possession, and is called in law a *special occupant;* as having a special exclusive right, by the terms of the original grant, to enter upon and occupy this *hæreditas jacens*, during the residue of the estate granted: though some have thought him so called with no very great propriety; and that such estate is rather a descendible freehold. But the title of *common occupancy* is now reduced almost to nothing by two statutes; the one, 29 Car. II. c. 3. which enacts, that where there is no special occupant, in whom the estate may vest, the tenant *pour autre vie* may devise it by will, or it shall go to the executors, and be assets in their hands for payment of debts: the other that of 14 Geo. II. c. 20. which enacts, that it shall vest not only in the executors, but, in case the tenant dies intestate, in the administrators also: and go in course of a distribution like a chattel interest.

By these two statutes the title of *common occupancy* is utterly extinct and abolished: though that of *special occupancy*, by the heir-at-law, continues to this day; such heir

Occupancy. heir being held to succeed to the ancestor's estate, not by descent, for then he must take an estate of inheritance, but as an occupant, especially marked out and appointed by the original grant. The doctrine of common occupancy, may, however, be usefully remembered on the following account, amongst others: That, as by the common law no occupancy could be of incorporeal hereditaments, as of rents, tithes, advowsons, commons, or the like, (because, with respect to them, there could be no actual entry made, or corporeal seisin had; and therefore by the death of the grantee *pour autre vie* a grant of such hereditaments was entirely determined): so now, it is apprehended, notwithstanding those statutes, such grant would be determined likewise; and the hereditaments could not be deviseable, nor vest in the executors, nor go in a course of distribution. For the statutes must not be construed so as to create any new estate, or to keep that alive which by the common law was determined, and thereby to defeat the granter's reversion; but merely to dispose of an interest in being, to which by law there was no owner, and which therefore was left open to the first occupant. When there is a residue left, the statutes give it to the executors, &c. instead of the first occupant; but they will not create a residue on purpose to give it to the executors. They only mean to provide an appointed instead of a casual, a certain instead of an uncertain owner, of lands which before were nobody's; and thereby to supply this *casus omissus*, and render the disposition of the law in all respects entirely uniform; this being the only instance wherein a title to a real estate could ever be acquired by occupancy.

For there can be no other case devised, wherein there is not some owner of the land appointed by the law. In the case of a sole corporation, as a parson of a church, when he dies or resigns, though there be no *actual* owner of the land till a successor be appointed, yet there is a *legal*, *potential*, ownership, subsisting in contemplation of law; and when the successor is appointed, his appointment shall have a retrospect and relation backwards, so as to entitle him to all the profits from the instant that the vacancy commenced. And in all other instances, when the tenant dies intestate, and no other owner of the lands is to be found in the common course of descents, there the law vests an ownership in the king, or in the subordinate lord of the fee, by escheat.

So also, in some cases, where the laws of other nations give a right by occupancy, as in lands newly created, by the rising of an island in a river, or by the alluvion or dereliction of the sea; in these instances, the law of England assigns them an immediate owner. For Bracton tells us, that if an island arise in the *middle* of a *river*, it belongs in common to those who have lands on each side thereof; but if it be nearer to one bank than the other, it belongs only to him who is proprietor of the nearest shore: which is agreeable to, and probably copied from, the civil law. Yet this seems only to be reasonable, where the soil of the river is equally divided between the owners of the opposite shores: for if the whole soil is the freehold of any one man, as it must be whenever a several fishery is claimed, there it seems just (and so is the usual practice) that the islets, or little islands, arising in any part of the river, shall be the property of him who owneth the piscary and the soil. However, in case a new island rise in the *sea*, though the civil law gives it to the first occupant, yet our's gives it to the king. And as to lands gained from the sea; either by *alluvion*, by the washing up of sand and earth, so as in time to make *terra firma*; or by *dereliction*, as when the sea shrinks back below the usual water-mark; in these cases the law is held to be, that if this gain be by little and little, by small and imperceptible degrees, it shall go to the owner of the land adjoining. For *de minimis non curat lex*: and, besides, these owners being often losers by the breaking in of the sea, or at charges to keep it out, this possible gain is therefore a reciprocal consideration for such possible charge or loss. But if the alluvion or dereliction be sudden and considerable, in this case it belongs to the king: for as the king is lord of the sea, and so owner of the soil while it is covered with water, it is but reasonable he should have the soil when the water has left it dry. So that the quantity of ground gained, and the time during which it is gained, are what make it either the king's or the subject's property. In the same manner, if a river, running between two lordships, by degrees gains upon the one, and thereby leaves the other dry, the owner who loses his ground thus imperceptibly has no remedy: but if the course of the river be changed by a sudden and violent flood, or other hasty means, and thereby a man loses his grounds, he shall have what the river has left in any other place as recompense for this sudden lose. And this law of alluvions and derelictions, with regard to *rivers*, is nearly the same in the imperial law; from whence indeed those our determinations seem to have been drawn and adopted: but we ourselves, as islanders, have applied them to *marine* increases; and have given our sovereign the prerogative he enjoys, as well upon the particular reasons before mentioned, as upon this other general ground of prerogative, which was formerly remarked, that whatever hath no other owner is vested by law in the king. See PREROGATIVE.

Occupancy ‖ Ocean.

OCCUPANT, in *Law*, the person that first seizes, or gets possession of a thing.

OCCUPATION, in a legal sense, is taken for use or tenure: as in deeds it is frequently said, that such lands are, or were lately, in the tenure or occupation of such a person.—It is likewise used for a trade or mystery.

OCCUPIERS *of* WALLING, a term used in the salt-works for the persons who are the sworn officers that allot in particular places what quantity of salt is to be made, that the markets may not be overstocked, and see that all is carried fairly and equally between the lord and the tenant.

OCEAN, that huge mass of salt waters which encompasses all parts of the globe, and by means of which, in the present improved state of navigation, an easy intercourse subsists between places the most distant.

The ocean is distinguished into three grand divisions. 1. The Atlantic ocean, which divides Europe and Africa from America, which is generally about 3000 miles wide. 2. The Pacific ocean, or South sea, which divides America from Asia, and is generally about 10,000 miles over. And, 3. The Indian Ocean, which separates the East Indies from Africa, which is 3000 miles over. The other seas, which are called *oceans*, are only parts or branches of these, and usually receive their names from the countries they border upon.

 For

For the saltness, tides, &c. of the ocean, see the articles SEA, TIDES, &c.

OCEANIDES, in fabulous history, sea nymphs, daughters of Oceanus, from whom they received their names, and of the goddess Tethys or Thetis. They were 3000 according to Apollodorus, who mentions the names of seven of them; Asia, Styx, Electra, Donis, Eurynome, Amphitrite, and Metis. Hesiod speaks of the eldest of them, which he reckons 41, Pitho, Admete, Prynno, Ianthe, Rhodia, Hippo, Callirhoe, Urania, Clymene, Idyia, Pasithoe, Clythia, Zeuxo, Galuxaure, Plexaure, Perseis, Pluto, Thoe, Polydora, Melobosis, Dione, Cerceis, Xanthe, Acasta, Ianira, Telestho, Europa, Menestho, Petræa, Eudora, Calypso, Tyche, Ocyroe, Crisia, Amphiro, with those mentioned by Apollodorus, except Amphitrite. Hyginus mentions 16, whose names are almost all different from those of Apollodorus and Hesiod; which difference proceeds from the mutilation of the original text. The Oceanides, like the rest of the inferior deities, were honoured with libations and sacrifices. Prayers were offered to them, and they were entreated to protect sailors from storms and dangerous tempests. The Argonauts, before they proceeded to their expedition, made an offering of flour, honey, and oil, on the sea shore, to all the deities of the sea, and sacrified bulls to them, and entreated their protection. When the sacrifice was made on the sea shore, the blood of the victim was received in a vessel; but when it was in open sea, they permitted the blood to run down into the waters. When the sea was calm, they generally offered a lamb or a young pig; but if it was agitated by the winds and rough, a black bull was deemed the most acceptable victim.

OCEANUS, in Pagan mythology, the son of Cœlus and Terra, the husband of Thetis, and the father of the rivers and fountains, called *Oceanides*. The ancients called him the *father of all things*, imagining that he was produced by Humidity, which, according to Thales, was the first principle from which every thing was produced. Homer represents Juno visiting him at the remotest limits of the earth, and acknowledging him and Thetis as the parents of the gods. He was represented with a bull's head, as an emblem of the rage and bellowing of the ocean when agitated by a storm.

According to Homer, he was the father even of all the gods, and on that account he received frequent visits from them. He is often, indeed almost always, represented as an old man with a long flowing beard, and sitting upon the waves of the sea. He often holds a pike in his hand, while ships under sail appear at a distance, or a sea monster stands near him. Oceanus presided over every part of the sea, and even the rivers were subjected to his power. The ancients were superstitious in their worship of him, and revered with great solemnity a deity to whose care they entrusted themselves when going on any voyage.

OCEIA, a woman who presided over the sacred rites of Vesta for 57 years with the greatest sanctity. She died in the reign of Tiberius, and the daughter of Domitius succeeded her.

OCELLUS *the* LUCANIAN, an ancient Greek philosopher of the school of Pythagoras, who lived before Plato. His work περι του Παντος, or "The Universe," is the only piece of his which is come down entire to us; and was written originally in the Doric dialect, but was translated by another hand into the Attic. William Christian, and after him Lewis Nogarola, translated this work into Latin; and we have several editions of it, both in Greek and Latin.

OCELOT, the Mexican cat. See FELIS, MAMMALIA *Index*.

OCHLOCRACY, that form of government wherein the populace have the chief administration of affairs.

OCHNA, a genus of plants belonging to the polyandria class; and in the natural method ranking with those of which the order is doubtful. See BOTANY *Index*.

OCHRE, in *Natural History*, a mineral substance composed of oxide and carbonate of iron, and clay. See ORES OF IRON, MINERALOGY *Index*.

OCHROMA, a genus of plants belonging to the monadelphia class; and in the natural method ranking under the 37th order, *Columniferæ*. See BOTANY *Index*.

OCHUS, a king of Persia, son of Artaxerxes. He was cruel and avaricious; and in order to strengthen himself on his throne, he murdered all his brothers and sisters. His subjects revolted; but he reduced them to obedience, and added Egypt to his other dominions. Bagoas, his favourite eunuch, poisoned him for the insults he had offered to Apis the god of the Egyptians; and he gave his flesh to be eaten by cats, and made handles for knives with his bones. It seems to be not a little remarkable, that all those monsters who disgraced humanity by their crimes, and sunk themselves below the level of brutes, have met with condign punishment; and this in general seems true, whether we refer to ancient or modern times.—A man of Cyzicus, who was killed by the Argonauts.—A prince of Persia, who refused to visit his native country for fear of giving all the women each a piece of gold.—A river of India or of Bactriana.—A king of Persia: He exchanged his name for that of Darius Nothus. See PERSIA.

OCKLEY, SIMON, an eminent orientalist, and professor of Arabic in Cambridge, was born at Exeter in 1678. He was educated at Cambridge, and distinguished himself by uncommon skill in the Oriental languages. Having taken a degree in divinity, he was presented by Jesus College with the vicarage of Swavesey in 1705, and in 1711 was chosen Arabic professor of the university. He had a large family, and his latter days were rendered unhappy by pecuniary embarrassments. He died in 1720. His principal works are, 1. *Introductio ad linguas Orientales*, a small volume. 2. *The History of the present Jews throughout the world*, from the Italian of Leo Modena. 3. *The Improvement of Human Reason*, from the Arabic. 4. *The History of the Saracens*, in 2 vols. 8vo. This last work is justly valued for its accuracy and erudition, and has been highly commended by Samuel Johnson. A great part of his materials were drawn from Arabic manuscripts in the Bodleian library at Oxford.

OCRA, a viscous vegetable substance well known in the West Indies, where it is used to thicken soup, particularly that kind called pepper pot, as well as for other purposes.

OCRISIA, in fabulous history, the wife of Corniculus, was one of the attendants of Tanaquil the wife of Tarquinius

Tarquinius Priscus. As she was throwing into the flames, for offerings, some of the meats that were served on the table of Tarquin, she suddenly saw, as is reported, in the fire, what Ovid calls *obscœni forma virilis*. She informed the queen of it; and when by her command she had approached near it, she conceived a son who was named Servius Tullius, and was educated in the king's family. He afterwards suceeded to the vacant throne. Some suppose that Vulcan had assumed that form which was presented to the eyes of Ocrisia, and that this god was the father of the sixth king of Rome.

OCTAETERIS, a cycle or term of eight years, in the Grecian chronology, at the conclusion of which three entire lunar months were added. The cycle was in use till Meton's invention of the golden number or cycle of 19 years.

OCTAGON, or OCTOGON, in *Geometry*, is a figure of eight sides and angles; and this, when all the sides and angles are equal, is called a *regular octagon*, or one that may be inscribed in a circle.

OCTAGON, in *Fortification*, denotes a place that has eight bastions. See FORTIFICATION.

OCTAHEDRON, or OCTAEDRON, in *Geometry*, one of the five regular bodies, consisting of eight equal and equilateral triangles.

OCTANDRIA (οκτω, "eight," and ανηρ, a "man or husband,") the 8th class in Linnæus's sexual system; consisting of plants which are furnished with eight stamina. See BOTANY *Index*.

OCTANT, the eighth part of a circle.

OCTANT, or OCTILE, in *Astronomy*, that aspect of two planets, wherein they are distant an eighth part of a circle, or 45° from each other.

OCTAPLA, in matters of sacred literature, denotes a Polyglot Bible, consisting of eight columns, and as many different versions of the sacred text; viz. the original Hebrew both in Hebrew and Greek characters, Greek versions, &c.

OCTATEUCH, an appellation given to the eight first books of the Old Testament.

OCTAVE, in *Music*. See INTERVAL.

OCTAVIA, daughter of Caius Octavius and sister to Augustus Cæsar. See the following article. She was one of the most illustrious ladies of ancient Rome; her virtues and her beauty were equally conspicuous.—Prideaux says she was much handsomer than Cleopatra. She married Claudius Marcellus, and after his death M. Antony. Her marriage with Antony was a political match, to reconcile her brother and him together. Antony proved for some time attentive to her: but when he had seen Cleopatra, he neglected and despised her: and when she attempted to withdraw him from this illegal amour by going to meet him at Athens, she was rebuked and totally banished from his presence. This affront was highly resented by her brother; and though Octavia endeavoured to pacify him by palliating Antony's behaviour, yet he resolved to revenge her cause by arms. After the battle of Actium and the death of Antony, Octavia, forgetful of her own injuries, took into the house all the children of her husband, and treated them with extraordinary tenderness. Marcellus, her son by her first husband, was married to a niece of Augustus, and openly intended as a successor to his uncle. His sudden death plunged all the family into the greatest grief. Virgil, whom Augustus patronized, undertook of himself to pay a melancholy tribute to the memory of a young man whom Rome had looked upon as her future father and patron. He was desired to repeat his composition in the presence of the emperor and his sister. Octavia burst into tears even when the poet began; but when he mentioned *Tu Marcellus eris*, she swooned away. This tender and pathetic encomium upon the merit and the virtues of young Marcellus she liberally rewarded; and Virgil received 10,000 sesterces, according to some 78l. 2s. 6d. for every one of the verses. Octavia had two daughters by Antony, Antonia Major and Antonia Minor.—The elder married L. Domitius Ahenobarbus, by whom she had Cn. Domitius, who was the father of the emperor Nero by Agrippina the daughter of Germanicus. Antonia Minor, who was as virtuous and as beautiful as her mother, married Drusus the son of Tiberius, by whom she had Germanicus, and Claudius who reigned before Nero. The death of Marcellus constantly preyed upon the mind of Octavia, who died of grief or melancholy, about 11 years before the Christian era. Her brother paid great regard to her memory, and pronounced her funeral oration himself. The Roman people also showed their regard to her virtues, by wishing to pay her divine honours.—A daughter of the emperor Claudius by Messalina. She was betrothed to Silanus, but by the intrigues of Agrippina, she was married to the emperor Nero in the 16th year of her age. She was soon after divorced under pretence of barrenness; and the emperor married Poppæa, who exercised her enmity upon Octavia by procuring her to be banished into Campania. She was afterwards recalled by the people; but Poppæa, who was determined on her ruin, caused her again to be banished to an island, where she was ordered to kill herself by opening her veins. Her head was cut off and carried to Poppæa.

OCTAVIANUS, or OCTAVIUS CÆSAR, was nephew of Julius Cæsar the dictator, being the son of Accia his sister by Octavius a senator, and afterwards became the second emperor of Rome. He was born in the year of the city 691, during the consulship of Cicero. His uncle Julius Cæsar adopted him, and left him the greatest part of his fortune. When he was but 20 years of age, he was raised to the consulship. His youth and inexperience were ridiculed by his enemies; notwithstanding which obstacle, his prudence and valour raised his consequence. He made war against his opponents on pretence of avenging the assassination of his uncle. He engaged in five civil wars with great success, viz. The wars of Mutina, Perusia, Philippi, Sicily, and Actium: the first and last of which were against M. Antony; the second against L. Antony, brother of the triumvir; the third was against Brutus and Cassius; and the fourth against Sext. Pompey, son of Pompey the Great. He united his forces with Antony's at the battle of Philippi; and had he not been supported by the activity and bravery of his colleague, he would doubtless have been totally ruined in that engagement. In his triumvirate with Antony and Lepidus, he obtained the western parts of the Roman empire; and, like his other colleagues, more firmy to establish his power, he proscribed his enemies and cut them off. The triumvirate lasted for 10 years. He had given his sister Octavia in marriage

Octavianus. marriage to Antony, to make their alliance more lasting; but when Cleopatra had charmed this unfortunate man, Octavia was repudiated. Augustus immediately took up arms to avenge the wrongs of his sister; but perhaps more eager to remove a man whose power and existence kept him in continual fear and constant dependence. Both parties met at Actium to decide the fate of Rome. Antony was supported by all the power of the east, and Augustus by Italy. Cleopatra fled from the battle with 60 ships; and her flight ruined the interest of Antony, who followed her into Egypt. The conqueror soon after went into Egypt likewise, besieged Alexandria, and honoured with a magnificent funeral his unfortunate colleague and the celebrated queen, whom the fear of being led in the victor's triumph at Rome had driven to commit suicide. After he had established peace all over the world, he shut the gates of the temple of Janus, A. U. C. 753. He was twice determined to lay down the supreme power immediately after the victory obtained over Antony, and on account of his ill health; but his two faithful friends Mecænas and Agrippa dissuaded him, and contended, that if he did he would leave it to be the prey of the most powerful, and expose himself to the greatest dangers. He died at Nola in the 76th year of his age, after he had held the sovereign power for 57 years.—He was an active emperor, and consulted the good of the Romans with the greatest anxiety and care. He visited all the provinces except Africa and Sardinia, and his consummate prudence and experience occasioned many salutary laws. He is, however, accused of licentiousness and adultery; but the goodness of his heart, the fidelity of his friendship, and the many good qualities which the poets whom he patronized have perhaps truly celebrated, made some, though in the eye of strict religion and true morality but little, amends for his natural foibles. He was ambitious of being esteemed handsome; and as he was publicly reported to be the son of Apollo according to his mother's declaration, he wished his flatterers to represent him with the figure and attributes of that god. Like Apollo, his eyes were clear, and he affected to have it thought that they possessed some divine irradiation, and was well pleased if, when he fixed his eyes upon any body, they held down their eyes, as if overcome by the glaring brightness of the sun. He distinguished himself by his learning; he was a complete master of the Greek language, and wrote some tragedies, besides memoirs of his life and other works, which are now lost. He married four times; but he was unhappy in all these connexions; and his only daughter Julia disgraced herself and her father by the debauchery and licentiousness of her manners. He recommended at his death his adopted son Tiberius as his successor. He left his fortune partly to him and to Drusus, and made donations to the army and Roman people. The title of Augustus was conferred upon him by the senate after the battle of Actium and the final destruction of the Roman republic. The title continued afterwards, being given to his successors in the empire. Virgil is said to have written his Æneid at the desire of Augustus, whom he represents under the amiable and perfect character of Æneas. The name of Octavius was very common at Rome; it was the name of a variety of men of very considerable rank.

OCTOBER, in *Chronology*, the eighth month of Romulus's year, which the name implies; but tenth in the kalendar of Numa, Julius Cæsar, &c. The senate gave this month the name *Faustinus*, in compliment to Faustina, the wife of the emperor Antoninus; Commodus would have it called *Invictus;* and Domitian named it *Domitianus;* but in spite of all these attempts it still retains its original name. This month was sacred to Mars, and under his protection.

October Equus, a horse annually sacrificed to Mars in the month of October, either because the horse is a warlike animal, or to punish him for the taking of Troy. A race was run with chariots, drawn by two horses, previous to the sacrifices, and he that ran quickest was adjudged to be the victim.

OCTOSTYLE, in the ancient architecture, is the face of an edifice adorned with eight columns.

OCULUS, the Eye, in *Anatomy*. See there, No. 145.

OCYMOPHYLLON, a name given by Buxbaum to a new genus of plants, the characters of which are these: The flower is of the stamineous kind, having no petals; this stands upon the embyro fruit, which afterwards becomes an oblong quadrangular seed-vessel, divided into four cells, and containing roundish and very small seeds; its leaves are like those of the common ocymum or basil, whence its name; and its place of growth is in damp marshes. Boccone has described it under the improper name of *glaux*, calling it the *great, green-flowered, marsh glaux*.

OCYMUM, Basil; a genus of plants belonging to the didynamia class; and in the natural method ranking under the 42d order, *Verticillatæ*. See Botany *Index*.

OCZAKOW, or Oczakoff, a town in southern Russia in the province of Cherson, and formerly belonging to Turkey. It had a Turkish garrison of 20,000 men, but was taken by the Russians in 1737, and all those that resisted were put to the sword. The Russians themselves lost 18,000 men in the assault. The Turks returned the same year with 70,000 men to retake it; but were obliged to retire, after the loss of 20,000. In 1738, the Russians withdrew their garrison, and demolished the fortifications. It is seated on the river Bog, to the west of the Nieper, or rather where they both unite and fall into the Black sea. It is 42 miles south-west of Bialagrod, and 190 north by east of Constantinople. It has been again lately a subject of contest between the Russians and Turks, but finally remains in the possession of the latter. Its population has diminished, and its importance sunk, since the rise of Odessa. E. Long. 30. 50. N. Lat. 46. 50.

ODA, in the Turkish seraglio, signifies a class, order, or chamber. The grand signior's pages are divided into five classes or chambers. The first, which is the lowest in dignity, is called the *great oda*, from the greater number of persons that compose it; these are the juniors, who are taught to read, write, and speak the languages. The second is called the *little oda*, where from the age of 14 or 15 years, till about 20, they are trained up to arms, and the study of all the polite learning the Turks are acquainted with. The third chamber, called *kilar oda*, consists of 200 pages, who, besides their other exercises, are under the command of the kilardgi-bachi, and serve in the pantry and fruitery.

fruitery. The fourth consists only of 24, who are under the command of the khazineda-bachi, and have charge of the treasure in the grand signior's apartment, which they never enter with clothes that have pockets. The fifth is called *kas oda* or *privy-chamber*; and is composed of only 40 pages, who attend in the prince's chamber. Every night eight of these pages keep guard in the grand signior's bedchamber while he sleeps: they take care that the light, which is constantly kept in the room, does not glare in his eyes, lest it should awake him: and if they find him disturbed with troublesome dreams, they cause him to be awakened by one of their agas.

Oda-Bachi, or *Oddabassi*, an officer in the Turkish soldiery, equivalent to a serjeant, or corporal among us. The common soldiers and janizaries called *oldachis*, after having served a certain number of years, are always preferred, and made biquelairs; and of biquelairs in time become odobachis, i. e. corporals of companies, or chiefs of certain divisions whose number is not fixed; being sometimes ten, and sometimes twenty.

Their pay is six doubles per month; and they are distinguished by a large felt, a foot broad, and above a foot long, hanging on the back, with two long ostrich feathers.

ODDLY ODD. A number is said to be oddly-odd, when an odd number measures it by an odd number. So 15 is a number oddly-odd, because the odd number 3 measures it by the odd number 5.

ODE, in *Poetry*, a song or composition proper to be sung. See POETRY.

ODED, a prophet of the Lord, who being at Samaria when the Israelites of the ten tribes returned from the war with their king Pekah, together with 200,000 of the people of Judah captives, he went out to meet them, and said, "You have seen that the Lord God of your fathers was in wrath against Judah; he has therefore delivered them into your hands, and you have slain them inhumanly; so that your cruelty has ascended up into heaven; and more than this, you would make slaves of the children of Judah, who are your brethren, and would add this sin to the many others you have committed: therefore, hear the counsel that I give you; send back these captives, lest the Lord should pour out his fury upon you." Oded having done speaking, some of the chiefs of Samaria seconded him, and by their remonstrances prevailed with the Israelites to set the captives at liberty (2 Chron. xxviii). See AHAZ.

The enlargement of the captives being obtained, the principal men of Samaria took care of them, gave them clothes and food and other necessary assistance. After which they furnished them with horses, because the greatest part of them were so tired and exhausted that they were not able to walk. Thus they conducted them to Jericho, which was in the confines of the land of Judah. This is all that is come to our knowledge concerning the prophet Oded.

ODENSEE, the capital of the isle of Funen, a place of such high antiquity, that some Danish writers derive its foundation and name from Odin the god and hero of the Gothic nations. "Its name certainly occurs (says Mr Coxe) in the earliest ages of the Danish history; and it was a town of great note long before Copenhagen existed. Odensee stands upon a small river, not navigable, and about two miles from the bay of Stegestrand. Many of the houses are ancient, bearing dates about the middle of the 16th century; but part is newly built: it contains about 5200 inhabitants, who carry on some commerce, exporting chiefly grain and leather; the latter is much esteemed, and its goodness is supposed to arise from a certain property in the river water, in which it is soaked for tanning. The Danish cavalry are supplied from thence with the greatest part of their leathern accoutrements.

"Odensee is the seat of a bishop, which was founded by Harold Blaatand in 980, and is the richest in Denmark next to Copenhagen. It has a school, endowed by the celebrated Margaret of Valdemar, in which a certain number of scholars, from six to 16 years of age, are instructed gratis: they live and board in the town, and each receives a yearly pension; other scholarships have been also founded by private persons. The whole number amounted to 70. There is also a gymnasium, instituted by Christian IV. for the admission of students at the age of 16. The seminary was still further improved by the liberality of Holberg the Danish historian, who protected letters with the same zeal with which he cultivated them. It is now greatly fallen from its former flourishing state, containing, when I passed through the town, only eight students. The cathedral is a large old brick building, which has nothing remarkable except some costly monuments of a private Danish family. The church, which formerly belonged to the convent of Recolets, contains the sepulchre of John king of Denmark, and of his son Christian II." E. Long. 10. 27. N. Lat. 55. 28.

ODENATUS, a celebrated prince of Palmyra, who very early inured himself to bear fatigues, and by hunting leopards and wild beasts, accustomed himself to the labours of a military life. He was a faithful friend to the Romans; and when Aurelian had been taken prisoner by Sapor king of Persia, Odenatus warmly interested himself in his cause, and solicited his release, by writing to the conqueror, and by sending him presents. The king of Persia was offended at this liberty of Odenatus, he tore the letter, and ordered the presents that were offered to be thrown into a river, and in order to punish Odenatus, who had the impudence, as he called it, to pay homage to so great a monarch as himself, he commanded him to appear before him, on pain of being devoted to instant destruction with all his family if he dared to refuse. Odenatus despised this haughty summons of Sapor, and opposed force by force. He obtained some considerable advantages over the troops of the Persian king, and took his wife prisoner, with a great and rich booty. These services were observed with gratitude by the Romans; and Gallienus, the then emperor, named Odenatus as his colleague on the throne, and gave the title of *Augutsus* to his children, and to his wife the celebrated Zenobia. Odenatus invested with new power, resolved to signalize himself more conspicuously by conquering the barbarians of the north: but his exulting was of short duration: he perished by the dagger of one of his own relations, whom he had slightly offended at a domestic entertainment.—He died at Emessa about the 267th year of the Christian era. Zenobia succeeded to his titles and honours.

ODER, a river of Germany, which has its source near

Oder || Odin.

near a town of the same name in Silesia, and on the confines of Moravia. It runs north through that province, and then into the marche of Brandenburg and Pomerania, where it forms a large lake, afterwards falling into the Baltic sea by three mouths; between which lie the islands Usedom and Wolin. It passes by several towns; as Ratibor, Oppelen, Breslau, Glogau and Grossen, in Silesia; Francfort, Lebus, and Custrin, in Brandenburg; and Gartz, Stetin, Cammin, Wallin, Usedom, and Wolgast, in Pomerania.

ODESSA, a seaport town in the government of Cherson in southern Russia. It is situated on the Black sea, between the embouchures of the Dneiper and the Dneister, and has increased with wonderful rapidity. In 1795 there were but a few houses. In 1804, the number of inhabitants was 15,000, and in 1816 they have been stated to be 35,000. It is now the great entreport for the commerce of southern Russia. In the first six months of 1816, 498 vessels entered the port, and 246 departed, the latter carrying away Russian produce to the amount of 15,220,000 roubles. The port was naturally only an open road, but has been improved by works at a great expence, and rendered capable of holding 600 vessels. The principal exports consist of corn, salt beef, timber, &c. This port promises to become as important for the southern provinces as Petersburgh for the northern. The improvements made in the navigation of the Dneister, have induced the Poles to send a considerable portion of their produce down that river, whence it is conveyed by lighters to Odessa, and then shipped for the various markets in the Levant and the south of Europe.

ODEUM, in Grecian antiquity, a music theatre built by Pericles; the inside of which was filled with seats and ranges of pillars, and on the outside the roof descended shelving downwards from a point in the centre, with many bendings, in imitation of the king of Persia's pavilion. Here the musical prizes were contended for; and here also, according to Aristophanes, was a tribunal.

ODIN (see FREA), in *Mythology*, called also in the dialect of the Anglo-Saxons, *Woden* or *Wodan*, a name given by the ancient Scythians to their supreme god, and assumed, about 70 years before the Christian era, by Sigge, a Scythian prince, who conquered the northern nations, made great changes in their government, manners, religion, and enjoyed great honours, and had even divine honours paid him. According to the account given of this conqueror by Snorro, the ancient historian of Norway, and his commentator Torfæus, Odin was a Scythian, who withdrew himself, with many others in his train, by flight, from the vengeance of the Romans, under the conduct of Pompey; and having officiated as a priest in his own country, he assumed the direction of the religious worship, as well as the civil government, of the nations which he conquered. Having subdued Denmark, Sweden, and Norway, he retired to Sweden, where he died. There is nothing certain in this account; but it is probable, that the god, whose prophet or priest this Scythian pretended to be, was named *Odin*, and that the ignorance of succeeding ages confounded the deity with his priest, composing out of the attributes of the one, and the history of the other, the character of the northern conqueror. He deluded the people by his enchantments and skill in magic: having cut off the head of one Mimer, who in his lifetime was in great reputation for wisdom, he caused it to be embalmed, and persuaded the Scandinavians that he had restored it to the use of speech; and he caused it to pronounce whatever oracles he wanted. The Icelandic chronicles represent Odin as the most eloquent and persuasive of men; they ascribe to him the introduction of the art of poetry among the Scandinavians, and likewise the invention of the Runic characters. He had also the address to persuade his followers, that he could run over the world in the twinkling of an eye; that he had the direction of the air and tempests; that he could transform himself into all sorts of shapes, could raise the dead, could foretel things to come, deprive his enemies, by enchantment, of health and vigour, and discover all the treasures concealed in the earth. They add, that by his tender and melodious airs, he could make the plains and mountains open and expand with delight; and that the ghosts thus attracted, would leave their infernal caverns, and stand motionless about him. Nor was he less dreadful and furious in battle; changing himself into the shape of a bear, a wild bull, or a lion, and amidst ranks of enemies committing the most horrid devastation, without receiving any wound himself.

Dr Henry gives this account of him: "Odin is believed to have been the name of the one true God among the first colonies who came from the east and peopled Germany and Scandinavia, and among their posterity for several ages. But at length a mighty conqueror, the leader of a new army of adventurers from the east, overrun the north of Europe, erected a great empire, assumed the name of *Odin*, and claimed the honours which had been formerly paid to that deity. From thenceforward this deified mortal, under the name of *Odin* or *Wodin*, became the chief object of the idolatrous worship of the Saxons and Danes in this island, as well as of many other nations. Having been a mighty and successful warrior, he was believed to be the god of war, who gave victory, and revived courage in the conflict. Having civilized in some measure, the countries which he conquered, and introduced arts formerly unknown, he was also worshipped as the god of arts and artists. In a word, to this Odin his deluded worshippers impiously ascribed all the attributes which belong only to the true God: to him they built magnificent temples, offered many sacrifices, and consecrated the fourth day of the week, which is still called by his name in England and in all the other countries where he was formerly worshipped. Notwithstanding all this, the founders of all the kingdoms of the Anglo-Saxon heptarchy pretended to be descended from Wodin, and some of them at the distance only of a few generations."

ODIN's Fire. We have this account of it in Gough's Camden. "In Evie parish, in the Orkneys, near the sea, are some rocks, which frequently in the night appear on fire; and the church of St Michael there was often seen full of lights, called fires sent by St Odin to guard their tombs, but now ceased. This may be a meteor, or some inflammable matter on the cliffs, as at Charmouth, Dorset."

De Odio et Atia. See *False Imprisonment.*

The writ *de odio et atia* was anciently used to be directed to the sheriff, commanding him to inquire whether a prisoner charged with murder was committed upon just cause of suspicion, or merely *proper odium et atium*, for hatred and ill will; and if upon the inquisition due cause of suspicion did not then appear, then there issued another writ for the sheriff to admit him to bail. This writ, according to Bracton, ought not to be denied to any man; it being expressly ordered to be made out *gratis*, without any denial, by *magna charta*, c. 26. and statute Westm. 2. 13 Edw. I. c. 29. But the statute of Glocester, 6 Edw. I. c. 9. restrained it in the case of killing by misadventure or self-defence, and the statute 28 Edw. III. c. 9. abolished it in all cases whatsoever: but as the stat. 42 Ed. III. c. 1. repealed all statutes then in being, contrary to the great charter, Sir Edward Coke is of opinion that the writ *de odio et atia* was thereby revived. See *Habeas Corpus.*

ODO, St, second abbot of Cluny in France, was illustrious for learning and piety in the 10th century. The sanctity of his life contributed greatly to enlarge the congregation of Cluny; and he was so esteemed, that popes, bishops, and secular princes, usually chose him the arbiter of their disputes. He died about the year 942, and his works are printed in the Bibliotheque of Cluny.

Odo Cantianus, so called as being a native of Kent in England, was a Benedictine monk in the 12th century, in which order his learning and eloquence raised him to the dignity of prior and abbot. Archbishop Becket was his friend; and his panegyric was made by John of Salisbury. He composed Commentaries on the Pentateuch, and the Second Book of Kings; Moral Reflections on the Psalms; treatises entitled, *De Onere Philistini; De Moribus Ecclesiasticis; De Vitiis et Virtutibus Animæ*, &c.

ODOACER, according to Ennodius, was meanly born, and only a private man in the guards of the emperor Augustulus, when (A. D. 476, under the consulship of Basilicus and Armatus) the barbarians chose him for their leader. The barbarians thought, as they often defended Italy, they had a right at least to part of it; but upon demanding it they were refused, and the consequence was a revolt. Odoacer is said to have been a man of uncommon parts, capable alike of commanding an army or governing a state. Having left his own country when he was very young, to serve in Italy, as he was of a stature remarkably tall, he was admitted among the emperor's guards, and continued in that station till the above year; when, putting himself at the head of the barbarians in the Roman pay, who, though of different nations, had unanimously chosen him for their leader, he marched against Orestes, and his son Augustulus, who still refused to share any of the lands in Italy. The Romans were inferior both in numbers and valour, and were easily conquered: Orestes was ordered to be slain; but the emperor Augustulus was spared, and, though stripped of his dignity, was treated with humanity, and allowed a liberal sum for his own support and for that of his relations. Odoacer was proclaimed king of Italy; but assumed neither the purple nor any other mark of imperial consequence. He was afterwards defeated and slain by Theodoric the Ostrogoth. See Ostrogoth.

ODOMETER, an instrument for measuring the distance passed over in travelling. See Pedometer.

ODONTALGIA, the Toothach. See Medicine, N° 210.

ODONTOIDE, in *Anatomy*, an appellation given to the process of the second vertebra of the neck, from its resemblance to a tooth.

ODOROUS, or Odoriferous, appellations given to whatever smells strongly, whether they be fetid or agreeable; but chiefly to things whose smell is brisk and pleasant.

ODYSSEY, the name of an epic poem composed by Homer, which, when compared with the Iliad, exhibits its author as the setting sun, whose grandeur remains without the heat of his meridian beams.

The poet's design in the Odyssey was to paint the miseries of a kingdom in the absence of its supreme governor, and the evil consequences resulting from a disregard of law, and of that subordination without which society cannot exist. With this view he sets before his countrymen the adventures of a prince who had been obliged to forsake his native country, and to head an army of his subjects in a foreign expedition; and he artfully contrives, without interrupting the narrative, to make the reader acquainted with the state of the country in the absence of its sovereign. The chief having gloriously finished the enterprise in which he was engaged, was returning with his army; but in spite of all his eagerness to be at home, he was detained on the way by tempests for several years, and cast upon several countries differing from each other in manners and in government. In these dangers his companions, not strictly obeying his orders, perish through their own fault. In the mean time the grandees of his country abuse the freedom which his absence gave them; consume his estate; conspire to destroy his son; endeavour to compel his queen to accept one of them for her husband; and indulge themselves in every species of violence, from a persuasion that he would never return. In this they were disappointed. He returns; and discovering himself only to his son and some others who had maintained their allegiance, he is an eye witness of the insolence of his enemies, punishes them according to their deserts, and restores to his island that tranquillity and repose to which it had been a stranger during the many years of his absence.

Such is the fable of the Odyssey, in which there is no opportunity of displaying that vigour and sublimity which characterize the Iliad. "It descends from the dignity of gods and heroes*, and warlike achievements; but in recompense we have more pleasing pictures of ancient manners. Instead of that ferocity which reigns in the other poem, this presents us with the most amiable images of hospitality and humanity; entertains us with many a wonderful adventure; and instructs us by such a constant vein of morality and virtue which runs through the poem," sometimes in precepts, and always in the conduct of the hero, that we should not wonder if Greece, which gave the appellation of *wise* to men who uttered single sentences of truth, had given to Homer the title of *the father of virtue*, for introducing into his work such a

* Blair's Lectures.

a number of moral maxims. As a poem, however, the Odyssey has its faults. The last twelve books are tedious and languid; and we are disappointed by the calm behaviour of Penelope upon the discovery of her long lost husband.

OECONOMICS, the art of managing the affairs of a family or community; and hence the person who takes care of the revenues and other affairs of churches, monasteries, and the like, is termed *œconomus*.

OECONOMISTS, a sect of French philosophers, who obtained this name in consequence of directing their attention and researches to objects of political economy, and in particular to the improvement of the departments of finance. The views of those philosophers, among whom are reckoned the celebrated names of Voltaire, d'Alembert, Diderot, and Condorcet, have been variously represented; by some as directly hostile to all regular government, and by others as unfriendly to religion.

OECONOMY, denotes the prudent conduct, or discreet and frugal management, whether of a man's own estate or that of another.

Animal OECONOMY, comprehends the various operations of nature in the generation, nutrition and preservation of animals *. The doctrine of the animal economy is nearly connected with physiology, which explains the operation and action of the several parts of the human body, their use, &c. See ANATOMY and PHYSIOLOGY.

* See *Generation, Nutrition*, &c.

OECUMENICAL, signifies the same with *general* or *universal*; as, œcumenical council, bishop, &c.

OEDEMA, or PHLEGMATIC TUMOUR, in *Medicine* and *Surgery*, a sort of tumour attended with paleness and cold, yielding little resistance, retaining the print of the finger when pressed with it, and accompanied with little or no pain.

This tumour obtains no certain situation in any particular part of the body, since the head, eyelids, hands, and sometimes part, sometimes the whole body, is afflicted with it. When the last mentioned is the case, the patient is said to be troubled with a cachexy, leucophlegmatia, or dropsy. But if any particular part is more subject to this disorder than another, it is certainly the feet, which are at that time called *swelled* or *œdematous feet*.

OEDERA, in *Botany*, a genus of plants belonging to the syngenesia class. See BOTANY *Index*.

OEDIPUS, the unfortunate king of Thebes, whose history is partly fabulous, flourished about 1266 B. C. It is said he was given by his father to a shepherd, who was ordered to put him to death, in order to prevent the misfortunes with which he was threatened by an oracle. But the shepherd, being unwilling to kill him with his own hands, tied him by the feet to a tree, that he might be devoured by wild beasts. The infant was however found in this situation by another shepherd named *Phorbas*, who carried him to Polybus king of Corinth; where the queen, having no children, educated him with as much care as if he had been her own son. When he was grown up, he was informed that he was not the son of Polybus; on which, by order of the oracle, he went to seek for his father in Phocis; but scarce was he arrived in that country, when he met his father on the road, and killed him without knowing him. A short time after, having delivered the country from the monster called the *Sphinx*, he married Jocasta, without knowing that she was his mother, and had four children by her; but afterwards, being informed of his incest, he quitted the throne, and, thinking himself unworthy of the light, put out his eyes. Eteocles and Polynices, who were celebrated among the Greeks, were born of this incestuous marriage.

OEGWA, a town on the Gold coast of Africa, situated, according to Artus, on the brow of an eminence, raising itself by a gentle ascent to a considerable height, and defended by rocks, against which the waves beat with the utmost violence, the noise of which is heard at a great distance.

Barbot affirms, that Oegwa contains above 500 houses disjoined by narrow crooked streets; and that from the sea it has the appearance of an amphitheatre. Des Marchias reduces the number of houses to 200, in the centre of which stands a large square building, the repository of their gold dust and other commodities. The houses are built of earth and clay, but convenient and well furnished with chairs, stools, mats, carpets, earthen pots, and even looking-glasses, which last they purchase from the Europeans. No part of the coast is better provided with all kinds of eatables, which are sent in from the adjacent cantons, and sold in public markets. Every thing is bought and sold with gold dust, which is the standard of all other commodities, and brought hither in great abundance from all quarters of Fetu, Abrambo, Assiento, and Mandingo. The gold is sold by weight, and the quantity determined by nice scales, made in the country before it was frequented by the Europeans: a proof that those negroes are not wholly ignorant of the more refined principles of mechanics. Next to gold, the chief commerce of the place consists in the sale of fish, of which they catch prodigious quantities on the coast. Although the natives are brave and warlike, yet in time of peace no people are more industrious, their whole time being employed in catching fish or cultivating the fruits of the earth. They are extremely expert in throwing the line, and fishing by the hook; nor is their intrepidity in combating the elements, and pursuing their employments in all kinds of weather, less astonishing. Every day in the week, except Wednesday, which is sacred to the Fetiche, they employ in their several occupations, and no season of the year is exempted from fishing. Their canoes weather storms which would endanger the largest shipping; and the negroes have the dexterity of making their advantage of those seasons, which oblige others to discontinue their labours, by throwing their lines with the same success in tempestuous as in calm weather.

OELAND, an island of Sweden, seated in the Baltic sea, between the continent of Gothland and the isle of Gothland. It lies between 56° and 57° of north latitude, and between 17° and 18° of east longitude. It is about 60 miles in length, and 15 in breadth; having a wholesome air, and a fertile soil, with rising hills, and several castles. It has no town of any great note.

OENANTHE, WATER DROPWORT, a genus of plants belonging to the pentandria class; and in the natural method ranking under the 45th order *Umbellatæ*. See BOTANY *Index*.

OENOPTÆ, in Grecian antiquity, a kind of censors

sors at Athens, who regulated entertainments, and took care that none drank too much, nor too little.

OENOS, in *Ornithology*, the name used by authors for the stock-dove, or wood pigeon, called also by some *vinago*, somewhat larger than the common pigeon, but of the same shape and general colour. Its neck is of a fine changeable hue, as differently opposed to the light; and its breast, shoulders, and wings, are of a fine purplish hue, or red wine colour, from whence it has its name *vinago*.

OENOTHERA, TREE-PRIMROSE, a genus of plants belonging to the octandria class; and in the natural method ranking under the 17th order, *Calycanthemæ*. See BOTANY *Index*.

OENOTRIA, an ancient name of Italy; so called from the *Oenotri*, (Virgil); inhabiting between Pæstum and Tarentum, (Ovid). Originally Arcadians, (Dionysius Halicarnasseus), who came under the conduct of Oenotrus son of Lycaon, 17 generations before the war of Troy, or 459 years, at 27 years each generation, and gave name to the people. Cato derives the name from *Oenotrus*, king of the Sabines and Etruscans; but Varro from *Oenotrus*, king of the Latins; and Servius from the Greek name for wine, for which Italy was famous; of which opinion is Strabo.

OENOTRIDES (Strabo, Pliny), two small islands in the Tuscan sea, over against Velia, a town of Lucania, called *Pontia* and *Iscia*; now *Penza* and *Ischia*, on the coast of the Principato Citra, or to the west of Naples. So called from the *Oenotri*, an ancient people of Italy.

OESEL, an island of the Baltic sea, at the entrance of the gulf of Livonia. It is about 70 miles in length, and 50 in breadth, and contains 10 parishes. It is defended by the fortresses of Airensburg and Sonneburg. It lies between 22° and 24° of east longitude, and between 58° and 59° of north latitude.

OESOPHAGUS, in *Anatomy*, the GULA, or *Gullet*, is a membranaceous canal, reaching from the fauces to the stomach, and conveying into it the food taken in at the mouth. See ANATOMY, N° 92.

OESTRUS, a genus of insects belonging to the order of diptera. See ENTOMOLOGY *Index*.

OETA, in *Ancient Geography*, a mountain of Thessaly, extending from Thermopylæ westward to the Sinus Ambracius, and in some measure cutting at right angles the mountainous country stretching out between Parnassus to the south, and Pindus to the north. At Thermopylæ it is very rough and high, rising and ending in sharp and steep rocks, affording a narrow passage between it and the sea from Thessaly to Locris (Strabo), with two paths over it; the one above Trachis, very steep and high; the other through the country of the Ænianes, much easier and readier for travellers; by this it was that Leonidas was attacked in rear by the Persians (Pausanias). Here Hercules laid himself on the funeral pile (Silius Italicus, Ovid); the spot thence called *Pyra* (Livy), who says that the extreme mountains to the east are called *Oeta*; and hence the poets allege, that day, night, sun, and stars, arose from Oeta (Seneca, Statius, Silius Italicus, Catullus, Virgil's *Culex*)—circumstances which show the height of this mountain.

OETING, a town of Germany, in Upper Bavaria, under the jurisdiction of Buckhausen. It is divided into the upper and the lower town, and seated on the river Inn, eight miles west of Buckhausen. E. Long. 12. 47. N. Lat. 48. 0. There is a great resort of pilgrims to the old chapel.

OETING, or *Oetingen*, a town of Germany, in the circle of Suabia, and capital of a county of the same name, seated on the river Wirnitz. E. Long. 10. 45. N. Lat. 48. 52.

OETING, a county of Germany, in the circle of Suabia, bounded on the north and east by Franconia; on the south by the duchy of Neuburg; and on the west by that of Wirtemberg. It is about 40 miles from east to west, and 20 from north to south.

OFFA's DYKE, an intrenchment cast up by Offa, a Saxon king, to defend England against the incursions of the Welsh. It runs through Hertfordshire, Shropshire, Montgomeryshire, Denbighshire, and Flintshire.

OFFANTO, a river of Italy, in the kingdom of Naples. It rises in the Apennine mountains, in the Farther Principato: and passing by Conza, and Monte Verde, it afterwards separates the Capitanata from the Basilicata and the Terra-di-Bari, and then it falls into the gulf of Venice, near Salpe.

OFFENCE, in *Law*, an act committed against the law, or omitted where the law requires it.

OFFERINGS. The Hebrews had several kinds of offerings, which they presented at the temple. Some were free-will offerings, and others were of obligation. The first fruits, the tenths, the sin offerings, were of obligation; the peace offerings, vows, offerings of wine, oil, bread, salt, and other things, which were made to the temple or to the ministers of the Lord, were offerings of devotion. The Hebrews called all offerings in general *corban*. But the offerings of bread, salt, fruits and liquors, as wine and oil, which were presented to the temple, they called *mincha*. The sacrifices are not properly offerings, and are not commonly included under that name. See CORBAN and SACRIFICE.

The offerings of grain, meal, bread, cakes, fruits, wine, salt, and oil, were common in the temple. Sometimes these offerings were alone, and sometimes they accompanied the sacrifices. Honey was never offered with the sacrifices; but it might be offered alone in the quality of first fruits. Now these were the rules that were observed in the presenting of those offerings, called in Hebrew *mincha*, or *korbon mincha*; in the Septuagint, *offerings of sacrifice*; and the same by St Jerome, *oblationem sacrificii*; but by our translators, *meat offerings* (Lev. ii. 1, &c.). There were five sorts of these offerings: 1. Fine flour or meal. 2. Cakes of several sorts, baked in an oven. 3. Cakes baked upon a plate. 4. Another sort of cakes, baked upon a gridiron, or plate with holes in it. 5. The first fruits of the new corn, which were offered either pure and without mixture, or roasted or parched in the ear or out of the ear.

The cakes were kneaded with oil olive, or fried with oil in a pan, or only dipped in oil after they were baked. The bread offered to be presented upon the altar, was to be without leaven; for leaven was never offered upon the altar, nor with the sacrifices. But they might make presents of common bread to the priests and ministers of the temple. See CAKE, &c.

The offerings now mentioned were appointed on account

count of the poorer sort, who could not go to the charge of sacrificing animals. And even those that offered living victims were not excused from giving meal, wine, and salt, which was to go along with the greater sacrifices. And also those that offered only oblations of bread or of meal, offered also oil, incense, salt, and wine, which were in a manner the seasoning of it. The priest in waiting received the offerings from the hand of him that offered them; laid a part of them upon the altar, and reserved the rest for his own subsistence: that was his right as a minister of the Lord. Nothing was burnt quite up but the incense, of which the priest kept back nothing for his own share.

When an Israelite offered a loaf to the priest, or a whole cake, the priest broke the loaf or the cake into two parts, setting that part aside that he reserved to himself, and broke the other into crumbs; poured oil upon it, salt, wine, and incense; and spread the whole upon the fire of the altar. If these offerings be accompanied by an animal for a sacrifice, it was all thrown upon the victim, to be consumed along with it.

If these offerings were the ears of new corn, either of wheat or barley, these ears were parched at the fire or in the flame, and rubbed in the hand, and then offered to the priest in a vessel; over which he put oil, incense, wine, and salt, and then burnt it upon the altar, first having taken as much of it as of right belonged to himself.

The greatest part of these offerings were voluntary, and of pure devotion. But when an animal was offered in sacrifice, they were not at liberty to omit these offerings. Every thing was to be supplied that was to accompany the sacrifice, and which served as a seasoning to the victim. There are some cases in which the law requires only offerings of corn, or bread: for example, when they offered the first fruits of their harvest, whether they were offered solemnly by the whole nation, or by the devotion of private persons.

As to the quantity of meal, oil, wine, or salt, which was to go along with the sacrifices, we cannot easily see that the law had determined it. Generally the priest threw an handful of meal or crumbs upon the fire of the altar, with wine, oil, and salt in proportion, and all the incense. All the rest belonging to him, the quantity depended upon the liberality of the offerer. We observe in more places than one, that Moses appoints an assaron, or the tenth part of an ephah of meal, for those that had not wherewithal to offer the appointed sin offerings (Lev. v. 11. xiv. 21.). In the solemn offerings of the first fruits for the whole nation, they offered an entire sheaf of corn, a lamb of a year old, two tenths or two assarons of fine meal mixed with oil, and a quarter of a hin of wine for the libation. (Lev. xxiii. 10, 11, 12, &c.)

In the sacrifice of jealousy (Numb. v. 15.), when a jealous husband accused his wife of infidelity, the husband offered the tenth part of a fatum of barley-meal, without oil or incense, because, it was a sacrifice of jealousy, to discover whether his wife was guilty or not.

The offerings of the fruits of the earth, of bread, of wine, oil, and salt, are the most ancient of any that have come to our knowledge. Cain offered to the Lord of the fruits of the earth, the first fruits of his labour (Gen. iv. 3, 4.). Abel offered the firstlings of his flocks, and of their fat. The heathen have nothing more ancient in their religion, than these sorts of offerings made to their gods. They offered clean wheat, flour, and bread.

OFFICE, a particular charge or trust, or a dignity attended with a public function. See HONOUR.—The word is primarily used in speaking of the offices of judicature and policy; as the office of secretary of state, the office of a sheriff, of a justice of peace, &c.

OFFICE also signifies a place or apartment appointed for officers to attend in, in order to discharge their respective duties and employments; as the secretary's office, ordnance office, excise office, signet office, paper office, pipe office, six clerks office, &c.

OFFICE, in *Architecture*, denotes all the apartments appointed for the necessary occasions of a palace or great house; as kitchen, pantries, confectionaries, &c.

OFFICE, in the canon law, is usual for a benefice, that has no jurisdiction annexed to it.

Duty upon OFFICES *and Pensions*, a branch of the king's extrordinary perpetual revenue, consisting in a payment of 1s. in the pound (over and above all other duties) out of all salaries, fees, and perquisites of offices and pensions payable by the crown. This highly popular taxation was imposed by stat. 31 Geo. II. c. 22. and is under the direction of the commissioners of the land tax.

OFFICER, a person possessed of a post or office. See the preceding article.

The great officers of the crown, or state, are, The lord high steward, the lord high chancellor, the lord high treasurer, the lord president of the council, the lord privy seal, the lord chamberlain, the lord high constable, and the earl marshal; each of which see under its proper article.

Non-commissioned OFFICERS, are serjeant majors, quartermaster serjeants, serjeants, corporals, drum and fife majors; who are nominated by their respective captains, and appointed by the commanding officers of regiments, and by them reduced without a court-martial.

Orderly non-commissioned OFFICERS, are those who are orderly, or on duty for that week; who, on hearing the drum beat for orders, are to repair to the place appointed to receive them, and to take down in writing, in the orderly-book, what is dictated by the adjutant, or serjeant major: they are then immediately to show these orders to the officers of the company, and afterwards warn the men for duty.

Flag OFFICERS. See *FLAG Officers*, and ADMIRALS.

Commission OFFICERS, are such as are appointed by the king's commission. Such are all from the general to the cornet and ensign inclusive. They are thus called in contradistinction to non-commissioned officers. See *Non-commissioned* OFFICERS.

General OFFICERS, are those whose command is not limited to a single company, troop, or regiment; but extends to a body of forces composed of several regiments; such are the general, lieutenant general, major general, and brigadier.

OFFICERS *of the Household*. See the article HOUSEHOLD.

Staff OFFICERS, are such as, in the king's presence, bear a white staff or wand; and at other times, on their

their going abroad, have it carried before them by a footman bare-headed: such are the lord steward, lord chamberlain, lord treasurer, &c. The white staff is taken for a commission; and, at the king's death, each of these officers breaks his staff over the herse made for the king's body, and by this means lays down his commission, and discharges all his inferior officers.

Subaltern OFFICERS, are all who administer justice in the name of subjects; as those who act under the earl marshal, admiral, &c. In the army, the subaltern officers are the lieutenants, cornets, ensigns, serjeants, and corporals.

OFFICIAL, in the canon law, an ecclesiastical judge, appointed by a bishop, chapter, abbot, &c. with charge of the spiritual jurisdiction of the diocese.

OFFICIAL, is also a deputy appointed by an archdeacon as his assistant, who sits as judge in the archdeacon's court.

OFFICINAL, in *Pharmacy*, an appellation given to such medicines, whether simple or compound, as are required to be constantly kept in the apothecaries shops. The *officinal simples* are appointed by the College of Physicians; and the manner of making the compositions directed in their pharmacopœia. See MATERIA MEDICA.

OFFING, or OFFIN, in the sea language, that part of the sea a good distance from shore, where there is deep water, and no need of a pilot to conduct the ship: thus, if a ship from shore be seen sailing out to seaward, they say, *she stands for the offing;* and if a ship, having the shore near her, have another a good way without her, or towards the sea, they say, *that ship is in the offing.*

OFF-SETS, in *Gardening*, are the young shoots that spring from the roots of plants; which being carefully separated, and planted in a proper soil, serve to propagate the species.

OFF-SETS, in *Surveying*, are perpendiculars let fall, and measuring from the stationary lines to the hedge, fence, or extremity of an enclosure.

OGEE, or O. G. in *Architecture*, a moulding consisting of two members, the one concave and the other convex; or like an S. See ARCHITECTURE.

OGHAMS, a particular kind of stenography, or writing in cypher, practised by the Irish; of which there were three kinds: The first was composed of certain lines and marks, which derived their power from their situation and position, as they stand in relation to one principal line, over or under which they are placed, or through which they are drawn; the principal line is horizontal, and serveth for a rule or guide, whose upper part is called the left, and the under side the right; above, under, and through which line, the characters or marks are drawn, which stand in the place of vowels, consonants, diphthongs, and triphthongs. Some authors have doubted the existence of this species of writing in cypher, called *Ogham* among the Irish; but these doubts are perhaps ill founded: for several MSS. in this character still exist, from which Mr Astle has given a plate of them.

OGIVE, in *Architecture*, an arch or branch of a Gothic vault; which, instead of being circular, passes diagonally from one angle to another, and forms a cross with the other arches. The middle, where the ogives cross each other, is called the *key;* being cut in form of a rose, or a *cul de lampe*. The members or mouldings of the ogives are called *nerves*, *branches*, or *reins;* and the arches which separate the ogives, *double arches*.

OGYGES, king of the Thebans, or, according to others, of Ogygia and Actæ, afterwards called *Bœotia* and *Attica*. He is recorded to have been the first founder of Thebes and Eleusis. The famous deluge happened in his time, in which some say he perished with all his subjects, 1796, B. C.

OGYGIA (Homer), the island of Calypso; placed by Pliny in the Sinus Scylaceus, in the Ionian sea, opposite to the promontory Lacinium; by Mela in the strait of Sicily, calling it *Æœa;* which others place at the promontory Circeium, and call it the island of *Circe*. Also the ancient name of Thebes in Bœotia.

OHIO, a river of North America. It is formed by the junction of the Alleghany and Monongahela rivers, which unite at Pittsburg, and take the name of Ohio. After a course of 1188 miles, it falls into the Mississippi in lat. 37. receiving fifteen rivers in its progress. During the high water of spring and autumn it is navigated by ships of 300 tons, and at all seasons by boats. The rapids at Louisville are the only obstruction; but the navigation will be continued here by a canal.

OHIO, the name of one of the United States of North America. It has the river Ohio on the south, Lake Erie and the Michigan territory on the north, Pennsylvania on the east, and Indiana on the west. It covers an area of 40,000 square miles. The surface is generally undulating, and towards the middle of the state is broken by low hills. The soil, which rests on limestone, has generally a great depth, and is remarkably fertile. It is watered by many large rivers, which are well stored with fish, and nearly all navigable. There are several salt springs, and coal is abundant. The mean heat of the climate at Cincinnati is $54\frac{1}{2}$ of Fahrenheit. The population in 1800 was only 42,156; but in 1810 had increased to 230,760, and in 1816 was estimated at 450,000. There are besides about 3000 Indians in the north-western parts. Slavery does not exist in this state. The average crop of Indian corn is reckoned 45 bushels an acre, of wheat 22, of rye 25, of oats 35, and of barley 30. Flax and hemp are cultivated, and a little tobacco, but cotton does not thrive. Vines, however, have been found to succeed. The price of good cleared land varies from two dollars to forty, according as it is near market towns. In 1810 there were three millions of pounds of maple sugar made in this state; a single tree yielding about 10 pounds. This territory was formed into a state and admitted into the Union in 1802. See UNITED STATES, SUPPLEMENT.

OHETEROA, one of the South sea islands lately discovered, is situated in W. Long. 150. 47. S. Lat. 22. 27. It is neither fertile nor populous, nor has it any harbour or anchorage fit for shipping; and the disposition of the people is hostile to such as visit them.

OIL, an unctuous inflammable substance, drawn from several natural bodies, as animal and vegetable substances. See CHEMISTRY and MATERIA MEDICA *Index*.

For the construction of an oil mill, see Gray's Experienced Millwright; and for an account of a very simple apparatus for expressing oils from different seeds at Bangalore in the East Indies, see Phil. Mag. vol. xxx. p. 329.

Rock Oil. See PETROLEUM, MINERALOGY *Index*.

OINTMENT, in *Pharmacy*. See UNGUENT, MATERIA MEDICA *Index*.

OISE, a department of France, comprising the northern part of what was formerly the Isle of France. The surface is diversified, the soil fertile, producing corn and fruits, but not the vine. There are numerous manufactures of cloth, linen, flannel, &c. The territorial extent of the department is 2294 square miles, or 1,139,190 *arpents*. The population in 1800 was 369,086; and the amount of contributions for the year 1802 was 4,714,895 francs. It is divided into four subprefectures, 35 cantons, and 738 communes. Beauvais is the chief town.

OKEHAM, the capital of Rutlandshire, in England, seated in a rich and pleasant valley, called the *vale of Catmus*. It is well built, contained 1111 inhabitants in 1811, has a good church, a free-school, and an hospital. W. Long. 0. 45. N. Lat. 52. 40.

OKINGHAM, or *Woxingham*, a town of Berkshire, in England, containing 1419 inhabitants, and noted for the manufacture of silk stockings. W. Long. 0. 50. N. Lat. 51. 26.

OKRA, the fruit of a species of hibiscus, which is employed in the West Indies in making soups. See BOTANY *Index*.

OLAUS MAGNUS. See MAGNUS.

OLAX, a genus of plants, belonging to the triandria class. See BOTANY *Index*.

OLD AGE. See LONGEVITY. Many methods have been proposed for lengthening life, and rendering old age comfortable. Cornaro's Treatise on this subject is known to every body, and needs not be quoted. To some of our readers the following set of resolutions will perhaps be new, and may certainly be useful.

The old men should resolve, except the reasons for a change be invincible, to live and to die in the public profession of the religion in which they were born and bred. To avoid all profane talk and intricate debates on sacred topics. To endeavour to get the better of the intrusions of indolence of mind and body, those certain harbingers of enfeebling age. Rather to wear out, than to rust out. To rise early, and as often as possible to go to bed before midnight. Not to nod in company, nor to indulge repose too frequently on the couch in the day. To waste as little of life in sleep as may be, for we shall have enough in the grave. Not to give up walking; nor to ride on horseback to fatigue. Experience, and a late medical opinion, determine to ride five miles every day: Nothing contributes more to the preservation of appetite, and the prolongation of life. Cheyne's direction to the valetudinary, "to make exercise a part of their religion," to be religiously observed. To continue the practice of reading, pursued for more than fifty years, in books on all subjects; for variety is the salt of the mind as well as of life. Other people's thoughts, like the best conversation of one's companions, are generally better and more agreeable than one's own. Frequently to think over the virtues of one's acquaintance, old and new. To admit every cheerful ray of sunshine on the imagination. To avoid retrospection on a past friendship, which had much of love in it; for memory often comes when she is not invited. To try to think more of the living and less of the dead; for the dead belong to a world of their own. To live within one's income, be it large or little. Not to let passion of any sort run away with the understanding. Not to encourage romantic hopes nor fears. Not to drive away hope, the sovereign balm of life, though he is the greatest of all flatterers. Not to be under the dominion of superstition or enthusiasm. Not wilfully to undertake any thing for which the nerves of the mind or the body are not strong enough. Not to run the race of competition, or to be in another's way. To avoid being jostled too much in the street, being overcome by the noise of the carriages, and not to be carried even by curiosity itself into a large crowd. To strive to embody that dignified sentiment, "to write injuries in dust, but kindnesses in marble." Not to give the reins to constitutional impatience, for it is apt to hurry on the first expressions into the indecency of swearing. To recollect, that he who can keep his own temper may be master of another's. If one cannot be a stoic, in bearing and forbearing, on every trying occasion, yet it may not be impossible to pull the check-string against the moroseness of spleen or the impetuosity of peevishness. Anger is a short madness. Not to fall in love, now on the precipice of threescore, nor expect to be fallen in love with. A connexion between summer and winter is an improper one. Love, like fire, is a good servant, but a bad master. Love is death, when the animal spirits are gone. To contrive to have as few vacant hours upon one's hands as possible, that idleness, the mother of crimes and vices, may not pay its visit. To be always doing of something, and to have something to do. To fill up one's time, and to have a good deal to fill up: for time is the materials that life is made of. If one is not able by situation, or through the necessity of raising the supplies within the year, or by habit (for virtue itself is but habit), to do much ostentatious good, yet do as little harm as possible. To make the best and the most of every thing. Not to indulge too much in the luxury of the table, nor yet to underlive the constitution. The gout, rheumatism, and dropsy, in the language of the Spectator, seem to be hovering over the dishes. Wine, the great purveyor of pleasure, and the second in rank among the senses, offers his service, when love takes his leave. It is natural to catch hold of every help, when the spirits begin to droop. Love and wine are good cordials, but are not proper for the beverage of common use. Resolve not to go to bed on a full meal. A light supper and a good conscience are the best receipts for a good night's rest, and the parents of undisturbing dreams. Not to be enervated by the flatulency of tea. Let the second or third morning's thought be to consider of the employment for the day; and one of the last at night to inquire what has been done in the course of it. Not to let one's tongue run at the expence of truth. Not to be too communicative nor unreserved. A close tongue, with an open countenance, are the safest passports through the journey of the world. To correct the error of too much talking, and restrain the narrativeness of the approaching climacteric. Not to like or dislike too much at first sight. Not to wonder, for all wonder is ignorance that possession falls short of expectation. The longing of twenty years may be disappointed in the unanswered gratification of a single hour.

hour. Whilst we are wishing, we see the best side; after we have taken possession, the worst. Resolve to attend to the arguments on both sides, and to hear every body against every body. The mind ought not to be made up, but upon the best evidence. To be affectionate to relations, which is a kind of self-love, in preference to all other acquaintance. But not to omit paying the commanding respect to merit, which is superior to all the accidental chains of kindred. Not to debilitate the mind by new and future compositions. Like the spider, it may spin itself to death. The mind, like the field, must have its fallow season. The leisure of the pen has created honourable acquaintance, and pleased all it has wished to please. To resolve not to be too free of promises, for performances are sometimes very difficult things. Not to be too much alone, nor to read, nor meditate, or talk too much on points that may awaken tender sensations, and be too pathetic for the soul. To enjoy the present, not to be made too unhappy by reflection on the past, not to be oppressed by invincible gloom on the future. To give and receive comfort, those necessary alms to a distressed mind. To be constantly thankful to providence for the plenty hitherto possessed, which has preserved one from the dependence on party, persons, and opinions, and kept one out of debt. The appearance of a happy situation, and opportunities of tasting many wordly felicities (for content has seldom perverted itself into discontent), has induced many to conclude, that one must be pleased with one's lot in life; and it occasions many to look with the eye of innocent envy. To resolve more than ever to shun every public station and responsibility of conduct. To be satisfied with being master of one's self, one's habits, now a second nature, and one's time. Determined not to solicit, unless trampled upon by fortune, to live and die in the harness of trade, or a profession. To take care that pity (humanity is not here meant) does not find out one in the endurance of any calamity. When pity is within call, contempt is not far off. Not to wish to have a greater hold of life, nor to quit that hold. The possible tenure of existence is of too short possession for the long night that is to succeed: therefore not a moment to be lost. Not to lose sight even for a single day, of these good and proverbial doctors—diet—merryman—and quiet. Resolved to remember and to recommend, towards tranquillity and longevity, the three oral maxims of Sir Hans Sloane —"Never to quarrel with one's self—one's wife—or one's prince." Lastly, Not to put one's self too much in the power of the elements, those great enemies to the human frame; namely, the sun—the wind—the rain—and the night air.

Old Man of the Mountain. See Assassins.

OLDCASTLE, Sir John, called the *Good Lord Cobham*, was born in the reign of Edward III. and was the first author as well as the first martyr among the English nobility: he obtained his peerage by marrying the heiress of that Lord Cobham who with so much virtue and patriotism opposed the tyranny of Richard II. By his means the famous statute against provisors was revived, and guarded against by severer penalties; he was one of the leaders of the reforming party; was at great expence in procuring and dispersing copies of Wickliffe's writings among the people, as well as by maintaining a number of his disciples as itinerant preachers. In the reign of Henry V. he was accused of heresy; the growth of which was attributed to his influence. Being a domestic in the king's court, the king delayed his prosecution that he might reason with him himself; but not being able to reclaim him to the church of Rome, he in great displeasure resigned him to its censure. He was apprehended and condemned for heresy; but escaping from the Tower, lay concealed for four years in Wales, until the rumour of a pretended conspiracy was raised against him, and a price set upon his head: he was at last seized and executed in St Giles's Fields; being hung alive in chains upon a gallows, and burned by a fire placed underneath. He wrote "Twelve Conclusions, addressed to the Parliament of England."

OLDENBURG, a duchy in the north-west of Germany, with a capital of the same name. It lies within the kingdom of Hanover. The royal house of Denmark derived its origin from the family to which this territory belonged, and retained the title. The account given by historians is as follows.

On the death of Christopher king of Denmark, &c. in 1448, without issue, there was a great contest about the succession; and a variety of factions were raised, particularly in Sweden and Norway, for the promotion of different persons; and various animosities and numerous discords were excited by the several parties, in order each to obtain their own ends.

As soon as these intrigues were known in Denmark, the senate resolved to proceed to the election of a king; for it did not appear expedient to commit the government of affairs to the queen dowager, at a time when they had every thing to fear from the two neighbouring crowns. At this time a lord of great weight, property, and ambition, sought the queen in marriage, the more easily to pave his way to the throne. But as for a great number of years there was no precedent for electing a king out of the body of nobility, though agreeable to law, the queen entered into the views of the senate, and declared she would give her hand to no prince who should not be judged deserving of the crown by the supreme council of the nation.

The advantages which would have accrued from annexing the duchy of Sleswick and Holstein to the crown, made the senate first cast their eyes on Adolphus. This matter required no long deliberation; all saw the conveniences resulting from such an union, and gave their assent. Immediately an embassy was despatched with the offer to Adolphus; but that prince consulting the good of his subjects, whose interest would have been absorbed in the superior weight of Denmark, declined it, with a moderation and disinterestedness, altogether uncommon among princes. However, that he might not be wanting in respect to the senate, he proposed to them his nephew Christian, second son to Theodoric, count of Oldenburg, a prince bred up at the court of Adolphus from his infancy. The proposition was so agreeable to the senate, that, without loss of time, the ambassadors were sent to Theodoric, to demand either of his sons he should pitch upon for their king. Theodoric's answer to the ambassadors was remarkable: "I have three sons, says he, of very opposite qualities. One is passionately fond of pleasure and women; another breathes nothing but war, without regarding the justice of the cause;

cause; but the third is moderate in his disposition, prefers peace to the din of arms, yet stands unrivalled in valour, generosity, and magnanimity." He said he painted these characters for the senate's information, desiring they would choose which of the young princes they believed would render the kingdom happiest. It was a matter which would admit of no hesitation: with one voice the senate declared for that prince whose panegyric the father had so warmly drawn; and under these happy auspices commenced the origin of the grandeur of the house of Oldenburg, at this day seated on the throne of Denmark.

OLDENBURG, *Henry*, a learned German of the 17th century, was descended from the noble family of his name, who were earls of the county of Oldenburg, in the north part of Westphalia, for many generations. He was born in the duchy of Bremen in the Lower Saxony; and during the long English parliament in King Charles I.'s time, was appointed consul for his countrymen, at London, after the usurpation of Cromwell; but being discharged of that employ, he was made tutor to the lord Henry O'Bryan, an Irish nobleman, whom he attended to the university of Oxford, where he was admitted to study in the Bodleian library in the beginning of the year 1656. He was afterwards tutor to William lord Cavendish, and was acquainted with Milton the poet. During his residence at Oxford, he became also acquainted with the members of that body there, which gave birth to the Royal Society; and upon the foundation of this latter, he was elected fellow; and when the society found it necessary to have two secretaries, he was chosen assistant secretary to Dr Wilkins. He applied himself with extraordinary diligence to the business of his office, and began the publication of the Philosophical Transactions with N° I. in 1664. In order to discharge this task with greater credit to himself and the society, he held a correspondence with more than seventy learned persons, and others, upon a vast variety of subjects, in different parts of the world. This fatigue would have been insupportable, had not he, as he told Dr Lister, managed it so as to make one letter answer another; and that to be always fresh, he never read a letter before he had pen, ink, and paper, ready to answer it forthwith; so that the multitude of his letters cloyed him not, nor ever lay upon his hands. Among others, he was a constant correspondent of Mr Robert Boyle, with whom he had a very intimate friendship; and he translated several of that ingenious gentleman's works into Latin.

Mr Oldenburg continued to publish the Transactions, as before, to N° xxxvi. June 25. 1677. After which the publication was discontinued till the January following, when it was again resumed by his successor in the secretary's office, Mr Nehemiah Grew, who carried it on till the end of February 1678. Our author dying at his house at Charleton, near Greenwich in Kent, in the month of August that year, was interred there.

OLDENLANDIA, a genus of plants belonging to the tetrandria class. See BOTANY *Index*.

OLDHAM, JOHN, an eminent English poet in the 17th century, son of a Nonconformist minister, was educated under his father, and then sent to Edmond hall in Oxford. He became usher to the free-school at Croydon in Surry; where he received a visit from the earls of Rochester and Dorset, Sir Charles Sedley, and other persons of distinction, merely upon the reputation of some verses of his which they had seen in manuscript. He was tutor to several gentlemen's sons successively; and having saved a small sum of money, came to London, and became a perfect votary to the bottle, being an agreeable companion. He was quickly found out here by the noblemen who had visited him at Croydon, who brought him acquainted with Mr Dryden. He lived mostly with the earl of Kingston at Holme Pierpoint in Nottinghamshire, where he died of the small-pox in 1683, in the 30th year of his age. His acquaintance with learned authors appears by his satires against the Jesuits, in which there is as much learning as wit discovered. Mr Dryden esteemed him highly. His works are printed in 2 vols 12mo. They chiefly consist of satires, odes, translations, paraphrases of Horace and other authors, elegiac verses, imitations, parodies, familiar epistles, &c.

OLD-HEAD, a promontory situated in the county of Cork, and province of Munster, four miles south of Kinsale, in the barony of Courcies, Ireland, which runs far into the sea, and on which is a lighthouse for the convenience of shipping. A mile from its extremity is an ancient castle of the lords of Kinsale, built from one side of the isthmus to the other, which defended all the lands towards the head: this place was formerly called *Duncearma*, and was the old seat of the Irish kings. The isthmus, by the working of the sea, was quite penetrated through, so as to form a stupendous arch, under which boats might pass from one bay to the other. Among the rocks of this coast there are aviaries of good hawks: also the sea eagles or ospreys build their nests and breed there.

OLDMIXON, JOHN, was descended from an ancient family in Somersetshire: he was a violent party-writer and malevolent critic, who would scarcely have been remembered, if Pope, in resentment of his abuse, had not condemned him to immortality in his Dunciad. His party-writings procured him a place in the revenue at Liverpool, where he died at an advanced age in the year 1745. Besides his fugitive temporary pieces, he wrote a History of the Stuarts, in folio; a Critical History of England, 2 vols 8vo; a volume of Poems, some dramatic pieces, &c.; none of them worthy of notice, his principal talent being that of falsifying history.

OLD-WIFE, or *Wrasse*. See LABRUS, } ICHTHYOLOGY *Index*.
OLD-WIFE *Fish*. See BALISTES, }

OLD-WOMAN'S ISLAND, a narrow slip of land, about two miles long, separated from Bombay in the East Indies by an arm of the sea, which, however, is passable at low water. It terminates at one extremity in a small eminence, on which a look-out house is kept for vessels. Near the middle are three tombs kept constantly white as land marks into the harbour. From the end of the island a dangerous ledge of rocks shoots forth, which are not very easily cleared. It produces only pasture for a few cattle.

OLEA, the *olive-tree*; a genus of plants belonging to the diandria class; and in the natural method ranking under the 44th order, *Sepiariæ*. See BOTANY *Index*.

OLEAGINOUS, something that partakes of the nature of oil, or out of which oil may be expressed.

OLEANDER,

OLEANDER, or Rose Bay, *nerium*; a genus of plants belonging to the pentandria class. See Botany *Index*.

OLECRANUM, or Olecranon, in *Anatomy*, the protuberance of the ulna, which prevents the joint of the elbow from being bent back beyond a certain length. See Anatomy, N° 51.

OLENUS, a Greek poet, older than Orpheus, came from Xanthe, a city of Lycia. He composed several hymns, which were sung in the island of Delos upon festival days. Olenus is said to have been one of the founders of the oracle at Delphi; to have been the first who filled at that place the office of priest of Apollo; and to have given responses in verse; but the truth of these assertions is very doubtful.

OLERON, an island of France, on the coast of Aunis and Saintogne, about five miles from the continent. It is 12 miles in length, and five in breadth; and is very fertile, containing about 12,000 inhabitants, who are excellent seamen. It is defended by a castle, which is well fortified; and there is a lighthouse placed there for the direction of ships. It is 14 miles south-east of Rochelle. W. Long. 1. 26. N. Lat. 46. 3.

Sea Laws of Oleron, certain laws relative to maritime affairs, made in the time of Richard I. when he was at the island of Oleron. These laws, being accounted the most excellent sea laws in the world, are recorded in the black book of the admiralty. See Selden's *Mare Clausum*.

OLEUM palmæ christi, commonly called *castor oil*, is extracted from the kernel of the fruit produced by the *Ricinus Americanus*. See Ricinus, Botany and Materia Medica *Index*.

OLFACTORY nerves. See Anatomy, N° 139 and 143.

OLGA, queen of Igor, the second monarch of Russia, who flourished about the year 880, having succeeded his father Ruric, who died in 878. Olga was born in Plescow, and was of the best family in that city. She bore him one son, called *Swetoslaw*. Igor being murdered by the Drewenses, or Drewliani, Olga revenged his death. She went afterwards, for what reason we know not, to Constantinople, where she was baptized, and received the name of *Helena*.

The emperor John Zimisces was her godfather, and fell in love with her as we are told; but she, alleging their spiritual alliance, refused to marry him. Her example made some impression upon her subjects, a good number of whom became converts to Christianity; but none upon her son, who reigned for a long time after her death, which happened at Pereslaw, in the 80th year of her age, 14 years after her baptism. The Russians to this day rank her among their saints, and commemorate her festival on the 11th of July.

OLIBANUM, in *Pharmacy*, a gummy resin, (the product of the *juniperus lycia* Lin.), brought from Turkey and the East Indies, usually in drops or tears. See Materia Medica *Index*.

OLIGARCHY, a form of government wherein the administration of affairs is confined to a few hands.

OLIO, or Oglio, a savoury dish, or food, composed of a great variety of ingredients; chiefly found at Spanish tables.

The forms of olios are various. To give a notion of this strange assemblage, we shall here add one from an approved author.

Take rump of beef, neats tongues boiled and dried, and Bologna sausages; boil them together, and, after boiling two hours, add mutton, pork, venison, and bacon, cut in bits; as also turnips, carrots, onions and cabbage, borage, endive, marigolds, sorrel, and spinach; then spices, as saffron, cloves, mace, nutmeg, &c. This done, in another pot put a turkey or goose, with capons, pheasants, wigeons and ducks, partridges, teals, and stock-doves, snipes, quails, and larks, and boil them in water and salt. In a third vessel, prepare a sauce of white wine, strong broth, butter, bottoms of artichokes, and chesnuts, with cauliflowers, bread, marrow, yolks of eggs, mace, and saffron. Lastly, Dish the olio by first laying out the beef and veal, then the venison, mutton, tongues, and sausages, and the roots over all; then the largest fowls, then the smallest, and lastly pour on the sauce.

OLISIPO, (Pliny, Antonine, Inscriptions); a town of Lusitania, situated on the north side of the frith of the Tagus; of such antiquity, that Solinus thought it was built by Ulysses; and Mela, probably to favour this opinion, writes, according to the common copies, *Ulyssipo*; both of them perhaps deceived by the similarity of sound. It was a municipium, with the surname *Felicitas Julia*, a privilege granted by the munificence of Augustus (Inscriptions, Pliny). Now Lisbon, capital of Portugal, situated on the north bank of the Tagus, distant about ten miles from its mouth. See Lisbon.

OLIVAREZ, Count de, by name *Don Gaspar de Guzman*, favourite and minister to Don Philip IV. of Spain, about 1620; a man of great parts and boundless ambition. Philip no sooner became king, than he became the subject of this his favourite. The king had abilities, it is true, but they lay dormant; and whilst he spent his time in listless inactivity, the whole government was under the direction of Olivarez. The count's management, indeed, was sufficiently dexterous in accomplishing his own designs; for by the best framed excuses, and on the most plausible pretexts, he removed all such as he thought stood in his way; nor did he stop there, but sometimes persecuted his rivals even to death, of which Don Rodrigo Calderona was a melancholy instance, an instance which at that time excited universal compassion. This minister, in short, had a genius of no common kind; added to which, he had a disposition which spurned all controul.

He had persecuted the late ministry for their pusillanimity in the management of affairs; he therefore thought it necessary, and it was certainly prudent, to pursue new measures. His self-sufficiency, though unbounded, was concealed under the veil of assumed modesty, and he was careful to make it appear that he was wholly taken up with the things of his own province. His politics were of a refined perhaps, but not of a very useful, tendency; for his imprudence, or his wrong notions on the subject, made him renew a war with Holland, contrary to the universal opinion of the council and the people. By the same imprudence, or by something worse, he provoked England, and obliged her to endeavour to humble the pride and lessen the authority of the house of Austria. Thus far he had been of little

Olivarez.

service to his country, having only provoked the resentment of the most powerful states, particularly England, France, Holland, &c. to conspire for its ruin. It is remarkable that Olivarez, notwithstanding this, never lost his credit; and indeed things so turned about in the end, that though Spain for a whole year was put to the severest trials, it acquired a degree of fame which sufficiently, in the general opinion, overbalanced some little loss. Olivarez too was particularly fortunate in making the peace; in which transaction he gained a very considerable advantage over Richelieu, so that things appeared to be still in a very favourable train. Fortune, however, was not always quite so indulgent to the schemes of this minister: he again drew Spain into a war with Mantua, contrary to the sentiments of the wisest men; from which is justly dated its declension, if not its ruin.

On the whole, Olivarez seems to have been always averse to peace; and with such a restless disposition, it is undoubtedly wonderful that he held his place so long and with so few complaints as he did.

It was certainly owing to his ambition and obstinacy, that an almost general war was excited about the year 1627, and which, as we have said, proved so fatal to Spain. So averse, indeed, does he appear to have been to peace, that he used every means in his power to prevent the restoration of it in Italy; and for this very purpose he sent Feria into Milan, whom he knew to be a man of such a temper and abilities as suited his purposes; for he was naturally averse to quiet. He endeavoured to break the alliances of the duke of Mantua by various stratagems; but they did not succeed: the schemes of Olivarez and the intrigues of Feria being totally defeated. Our minister had soon after this another cause of mortification, on Richelieu's being created a duke and peer of France, and unanimously admitted among the Venetian nobility; which could not fail to be a severe stroke on Olivarez, who considered him as his implacable enemy.

The people at length began to see and be displeased with his conduct; and with reason, had they known it all, for it was in many instances cruel and detestable. Indeed the differences which at that time had so long subsisted between France and Spain were the effect of the private animosity between him and Richelieu. Things, however, so turned about, and Spain was so unusually successful, that the faults of the minister were overlooked for the time; but this unexpected good fortune had no other effect than that of making him far more insolent than ever. He was, in every instance, one of the most headstrong and obstinate men in the world: he had set his heart on the reduction of Casal in Italy, and he was determined on it at whatever hazard; this foolish enterprise was, however, unaccountably defeated, and the Spanish army experienced a total defeat.

The revolt of the Catalans, whom he wished to deprive of their privileges, was the next consequence of his folly: he had privately employed the marquis de los Velez to extinguish this rebellion; but the cruelty of the measures used for this purpose only inflamed it the more. The revolution of Portugal, another disastrous event, was also the result of his obstinacy and rigour.

This series of ill fortune, which ought to have opened the eyes of the Catholic king and his ministers, seemed to infatuate both. The great secret by which Olivarez had governed his master was being the companion, or at least the confidant, of his pleasures. While he affected to deceive the world with a specious appearance of religion and piety, he was not only immersed in vice himself, but encouraged and promoted it in his prince, to the scandal of his subjects, and the prejudice of his affairs. At this time, of all others the most improper, Olivarez produced a bastard of his, hitherto called *Julian*; he had taken so little care of this son, that, not able to subsist in Spain, he had passed over to the Indies, where, in very mean stations, he had scarcely got bread. On him he now bestowed the name of *Don Henrico de Guzman*; and bringing him with great pomp and splendour to court, either flattered or forced the constable of Castile to give him his daughter; in consideration of which alliance he was to devolve upon him his duchy of St Lucar. In the beginning of his administration, by some accident or other, he presented to the king a memorial, in relation to an affair upon which his majesty had already received one from Don Balthasar de Zuniga: upon comparing them, they contradicted each other flatly. The king ordered a person of great quality to inquire thoroughly into this business; in consequence of which Don Balthasar's memorial appeared to be the truth, and that of Olivarez the reverse of it. The king was very angry; but the count regained his favour, by procuring for him the fair actress Calderona. By this woman he had a son, of whom no great notice was taken; but now, to obscure the folly of the count duke, this youth, scarce in the 14th year of his age, was produced, with the title of *Don Juan of Austria*, and declared generalissimo of the army against Portugal; while the heir apparent to the crown, Don Balthasar, was left under the tuition, or rather in the custody of the countess of Olivarez; at which conduct the queen was chagrined, the people enraged, and the world in general astonished.

His schemes now began to be entirely broken and defeated everywhere and in every kind; he fell under the displeasure of the queen, the emperor, the grandees, and the people all at once, and experienced the disgrace he had long merited. His ill fortune, which came upon him with the force of a torrent, did not, however, wholly overpower him; he was indeed obliged to conceal himself, in order to avoid the rage of the populace: but he had still confidence enough to offer an apology for his conduct, which possessed no inconsiderable share of wit and humour, well tempered with spirit and masterly reasoning. It was not, however, of any consequence to him; for he was banished to Toro, where, worn out by infirmities, or overcome by despair, he ended his days about the year 1645.

Olivarez || Olive Press.

OLIVE, the fruit of the olive tree. See OLEA, BOTANY *Index*.

OLIVE Press. In order to obtain the olive oil, the olives are first bruised in a rough trough, under a millstone, rolling perpendicularly over them; and when sufficiently mashed, put into the maye or trough, *m*, of an olive press, where *a a* are the upright beams, or cheeks; *b*, the female, and *c*, the male screw; *f*, the board on which the screw passes; *g*, a cubical piece of wood, called a *block*; *h*, the peel, a circular board, to be put under the block. By turning the screw, all the liquor

Plate CCCLXX.

liquor is pressed out of the mashed olives, and is called *virgin oil;* after which, hot water being poured upon the remainder in the press, a coarser oil is obtained. Olive oil keeps only about a year, after which it degenerates.

Olive Colour, a yellow mingled with black.

OLIVET, or *Mount of Olives*, in *Ancient Geography*, was situated to the east of the city of Jerusalem, and parted from the city only by the brook Kidron, and by the valley of Jehoshaphat, which stretches out from the north to the south. It was upon this mount that Solomon built temples to the gods of the Ammonites (1 Kings xi. 7.) and of the Moabites, out of complaisance to his wives, who were natives of these nations. Hence it is that the mount of Olives is called the *mountain of corruption* (2 Kings xxiii. 13.). Josephus says, that this mountain is at the distance of five stadia, or furlongs, from Jerusalem, which makes 625 geometrical paces, or the length of a Sabbath-day's journey, says St Luke (Acts i. 12.). The mount of Olives had three summits, or was composed of three several mountains, ranged one after another from north to south. The middle summit is that from whence our Saviour ascended into heaven. It was upon that towards the south that Solomon built temples to his idols. The summit which is most to the north is distant two furlongs from the middlemost. This is the highest of the three, and is commonly called Galilee.

In the time of King Uzziah, the mount of Olives was so shattered by an earthquake, that half of the earth that was on the western side fell down, and rolled four furlongs or 500 paces from thence, towards the mountain which was opposite to it on the east; so that the earth blocked up the highways, and covered the king's gardens.

Mr Maundrell tells us that he and his company going out of Jerusalem at St Stephen's gate, and crossing the valley of Jehoshaphat, began immediately to ascend the mountain; that being got above two-thirds of the way up, they came to certain grottoes cut with intricate windings and caverns under ground, which were called the sepulchres of the prophets; that a little higher up were twelve arched vaults under ground, standing side by side, and built in memory of the apostles, who are said to have compiled their creed in this place; that 60 paces higher they came to the place where Christ is said to have uttered his prophecy concerning the final destruction of Jerusalem; and a little on the right hand, to another, where he is said to have dictated a second time the Lord's prayer to his disciples; that somewhat higher is the cave of a saint called *Pelagia*; a little above that, a pillar denoting the place where an angel gave the Blessed Virgin three days warning of her death; and at the top of all, the place of our blessed Lord's ascension.

OLIVETAN, Robert, related to the famous Calvin, printed at Neufchatel in 1535, in folio, a version of the Bible into French, the first which had been translated from the original Hebrew and Greek. It is written in an uncouth and barbarous style, and is far from being faithful. The characters in which it is printed are Gothic, and the language of it is no less so. It is valued only because it is rare. Calvin is thought to have had a very considerable share in this translation. Olivetan survived his publication but a short time; for he was poisoned at Rome the year after, of which his translation is alleged to have been the cause. Olivetan's Bible, revised by John Calvin and N. Malinger, was reprinted at Geneva, in 1540, in quarto. This edition is still rarer than the former. It is called the *Bible de l'Epee*, because the printer had a sword for his sign.

OLIVIER, Claude Matthieu, advocate of the parliament of Aix, was born at Marseilles, in 1701, and appeared at the bar with eclat. He had a chief hand in the establishment of the academy of Marseilles, and was one of its original members. He possessed a quick and lively genius. A few hours retirement from society and from his pleasures were frequently sufficient to enable him to speak and write, even on important causes; but his works commonly bore marks of haste. Given to excess in every thing, he would employ a fortnight in studying the Code and the Digest, or in storing his mind with the beauties of Demosthenes, Homer, Cicero, or Bossuet: and then abandon himself for another fortnight, frequently a whole month, to a life of frivolity and dissipation. He died in 1736, at the age of 35. He published, 1. *L'Histoire de Philippe roi de Macedoine, et pere d'Alexandre le Grand*, 2 vols 12mo. No writer has so ably handled the history of the age of Philip, the interests of the different nations of Greece, and their manners and customs: but the conduct of the work is extremely defective. The digressions are too frequent, and often tedious. The style is in no respect suitable to a history. It is in general dry, unconnected, and like the style of a dissertation. Sometimes, however, we find in it passages full of fire and beauty, and turns of expression truly original. A disease of the brain, with which he was attacked, and under which he laboured several years, preventing him from putting his last hand to the work. 2. *Mémoire sur les secours donnés aux Romains par les Marseillois pendant la 2de Guerre Punique.* 3. *Mémoire sur les secours donnés aux Romains par les Marseillois durant la Guerre contre les Gaulois.*

OLMUTZ, a town of Germany, in Moravia, with a bishop's see, and a famous university, and containing 11,000 inhabitants. The public buildings are very handsome, particularly the Jesuits college. It is a trading place and very strong; and yet it was taken, with the whole garrison, by the king of Prussia in 1741. In July 1758 he besieged it again; and when he had almost taken the place, he was obliged to raise the siege, to go and meet the Russian army. It is seated on the river Morava. E. Long. 17. 35. N. Lat. 49. 30.

OLYMPIA, Maldachini Donna, a woman of a very uncommon character. She flourished about the middle of the 17th century. She was sister-in-law to Pope Innocent X. and had the address to acquire an unlimited power over this vain, weak, and injudicious ecclesiastic. Her son Camillo was promoted to the cardinalate, under the title of Pamphilio; but falling in love with the princess Rossana, a beautiful young widow, he laid aside his hat, and married. The crime, if it was one, was esteemed by the Romans in general at least venial. The pope, however, was displeased; and Olympia procured their banishment, being afraid lest her daughter-in-law should lessen her authority in the *sacred court*. This authority, equally unnatural and uncommon, reflected neither honour on her who held it, nor on the man who allowed her to hold it. Such elevated situations, Olympia. situations, however, whether they are the reward of merit, the effect of chance, or acquired by cunning, are seldom very secure. Olympia, who had procured the disgrace of many who did not deserve it, and who had herself long merited such a fate, at length experienced both disgrace and banishment. This was obtained by means of Cardinal Panzirollo, a great favourite of the pope's. The immediate cause of it was this: The pope had determined, in order to lessen his own trouble, to adopt a nephew, and to make him a *Cardinal Patron*, in order to give audience to ambassadors and ministers, and in his absence to preside at the council. For this purpose, at the recommendation of his favourite, his holiness make choice of Astalli, brother of the marquis Astalli, who had married a niece of Olympia. Olympia indeed was slightly consulted on the affair, and showed no disapprobation of the appointment. The pope, however, no sooner got him fixed in his new office, than he showed his own weakness by repenting of it. Olympia too was displeased, and by her solicitations procured the disgrace of Astalli, before he had enjoyed either the honours or emoluments of his office. Panzirollo, however, soon managed matters so as to turn the scales: he prevailed on the pope again to countenance and honour Astalli; and, what was more, had influence sufficient to persuade him to disgrace Olympia, and to banish her the court. She had indeed abused her authority in a most scandalous manner, and had gained such an absolute ascendant over the pope, that in every thing his will had been subservient to her dictates.—Her avarice and ambition were unbounded: she disposed of all benefices, which were kept vacant till she fully informed herself of their value: she rated an office of 1000 crowns for three years, at one year's revenue, and if for life, at 12 years purchase, one half of which sum she required to be paid in advance: she gave audience upon public affairs, enacted new laws, abrogated those of former popes, and sat in council with Innocent, with bundles of memorials in her hands. It was generally said that they lived together in a criminal correspondence, and that she had charmed him by some secret incantation. In the Protestant countries the loves and intrigues of Innocent and Donna Olympia were represented upon the stage; and severe sarcasms were daily put into the hands of Pasquin at Rome.—As she had usurped such an absolute authority, the new cardinal nephew saw the necessity of ruining her credit; he therefore seconded the endeavours of Panzirollo.—He insinuated to the pope, that his reputation had suffered greatly among the Catholics by her scandalous proceedings, and that his nuncios were treated with disrespect and contempt at the courts of the emperor, France, and Spain. Upon these representations, Innocent at length, but with great reluctance banished Olympia, and was reconciled to Prince Camillo and the princess Rossana; though some authors affirm that her banishment was no more than a political retreat, and that she still in private directed the affairs of the pope. A woman of Olympia's character, however, with such unbounded ambition, such an extravagant lust for power, and such an ambitious desire of wealth, and who had once possessed so great an ascendancy over such a man as Innocent, was not so easily to be put off. She was banished in 1650; but in 1653, she again assumed the supreme direction of affairs just as before her disgrace. She again accomplished the disgrace of Astalli, and procured the promotion of Azzolini to the office of secretary of the briefs. In 1654, his holiness resigned himself entirely into the hands of this assuming woman; who, observing his infirmities daily increasing, redoubled her rapacity, disposing of benefices to the highest bidders in all parts of Italy. She was again, however, in hazard of being displaced by a new favourite, viz. the cardinal de Retz; and had not the pope's dissolution prevented it, it would in all probability quickly have taken place. During his last illness he received nothing but from the hands of Donna Olympia, who was at great pains to prolong his life, watched continually at his bed side, and prevented the ambassadors or others from disturbing him with discourses upon business. She is said, during the last ten days of his life, when he continued without the use of reason, to have amassed about half a million of crowns. She did not find the succeeding pope (Alexander VII.) so easy to be played upon as his weak predecessor: a number of memorials were sent in against her, and his holiness was well disposed to attend to them: he ordered her to retire from Rome, and at the same time began to examine witnesses respecting her conduct. She was cut off, however, before the trial was finished, by the plague, which, in 1636, afflicted Rome and its neighbourhood. Her estate was not confiscated as was generally expected; and the prince Pamphilio was allowed to succeed her. The pope only reserved for his own relations about million of crowns.

OLYMPIA, in *Ancient Geography*, with the surname *Pisatis* (Strabo); so called from the territory of Pisa in Elis; described by Strabo, "as the temple of Jupiter Olympius, before which stands a grove of wild olive trees, in which is the stadium, or foot-course, so called because the eighth part of a mile; and by which the Alpheus, coming down from Arcadia, runs." Olympia, however, was famous not merely for the temple of Jupiter, but also for a temple of Juno, 63 feet long, with columns round it of the Doric order; and a Metroum or temple of the mother of the gods, a large Doric edifice; with holy treasuries. These, and the porticoes, gymnasium, prytaneum, and many more buildings, chiefly in the enclosure, with the houses of the priests and other inhabitants, made Olympia no inconsiderable place. The stadium was in the grove of wild olive trees, before the great temple; and near it was the hippodrome or course for the races of horses and chariots. The Alpheus flowed by from Arcadia with a copious and very pleasant stream, which was received on the coast by the Sicilian sea.

The temple of Jupiter was of the Doric order, 68 feet high to the pediment, 95 wide, and 230 long; the cell encompassed with columns. It was erected with the country stone; the roof not of earth baked, but of Pentelic marble; the slabs disposed as tiles; the way to it up a winding staircase. The two pediments were enriched with sculpture; and one had over the centre a statue of Victory gilded; and underneath a votive buckler of gold. At each corner was a gilded vase. Above the columns were fixed 21 gilded bucklers, offered at the conclusion of the Achæan war by the Roman general Mummius. The gates in the two fronts were

were of brass, and over them were carved the labours of Hercules. Within the cell were double colonnades, between which was the approach to the image.

The Jupiter of Olympia was accounted alone sufficient to immortalize its maker, Phidias. It was of ivory and gold, the head crowned with olive. In the right hand was a statue of Victory; in the left a flowered sceptre, composed of various metals, on which was an eagle. The sandals were of gold, as also the vestment, which was curiously embossed with lilies and animals. The throne was gold inlaid with ebony and ivory, and studded with jewels, intermixed with paintings and exquisite figures in relievo. The pillars between the feet contributed to its support. Before it were walls, serving as a fence, decorated principally with the exploits of Hercules; the portion opposite to the door of a blue colour. It was the office of a family descended from Phidias, called *phædruntæ* or *the polishers*, to keep the work bright and clean. The veil or curtain was cloth rich with the purple dye of Phœnicia and with Assyrian embroidery, an offering of King Antiochus, and was let down from above by loosening the strings. The image impressed on the spectator an opinion that it was higher and wider than it measured. Its magnitude is such, that though the temple was very large, the artist seemed to have erred in the proportions. The god, sitting, nearly touched the ceiling with his head; suggesting an idea, that if he were to rise up, he would destroy the roof. A part of the pavement before it was of black marble, enclosed in a rim of Parian or white, where they poured oil to preserve the ivory.

The altar of Jupiter Olympius was of great antiquity, and composed of ashes from the thighs of the victims, which were carried up and consumed on the top with wood of the white poplar tree. The ashes also of the prytaneum, in which a perpetual fire was kept on a hearth, were removed annually on a fixed day, and spread on it, being first mingled with water from the Alpheus. The cement, it was affirmed, could be made with that fluid only; and therefore this river was much respected, and esteemed the most friendly of any to the god. On each side of the altar were stone steps. Its height was 22 feet. Girls and women, when allowed to be at Olympia, were suffered to ascend the basement, which was 125 feet in circumference. The people of Elis sacrificed daily, and private persons as often as they chose.

Religion flourished at Olympia, and many deities were worshipped besides Jupiter. Pausanius has enumerated above 60 altars of various shapes and kinds. One of the unknown gods stood by the great altar. The people of Elis offered on all these monthly; laying on them boughs of olive; burning incense, and wheat mixed with honey; and pouring libations of such liquors as the ritual prescribed. At the latter ceremony sometimes a form of prayer was used, and they sung hymns composed in the Doric dialect.

Olympia was situated on an eminence, between two mountains called *Ossa* and *Olympus*. Though its ancient splendour is gone, the place reminds the traveller of what it once was. It is in the Morea, being now a small place called *Longinico*, 50 miles south of Lepanto, in E. Long. 22. 0. N. Lat. 37. 40.

OLYMPIAD, the space of four years, whereby the Greeks reckoned time.—The first Olympiad fell, according to the accurate and learned computation of some of the moderns, exactly 776 years before the first year of Christ, or 775 before the year of his birth, in the year of the Julian period 3938, and 22 years before the building of the city of Rome. The games were exhibited at the time of the full moon next after the summer solstice; therefore the Olympiads were of unequal length, because the time of the full moon differs 11 days every year, and for that reason they sometimes began the next day after the solstice, and at other times four weeks after. The computation by Olympiads ceased, as some suppose, after the 304th, in the year 440 of the Christian era. It was universally adopted not only by the Greeks, but by many of the neighbouring countries; though still the Pythian games served as an epoch to the people of Delphi and to the Bœotians; the Nemæan games to the Argives and Arcadians; and the Isthmian to the Corinthians and the inhabitants of the Peloponnesian isthmus. To the Olympiads history is much indebted. They have served to fix the time of many momentous events; and indeed before this method of computing time was observed, every page of history is mostly fabulous, and filled with obscurity and contradiction, and no true chronological account can be properly established and maintained with certainty.

OLYMPIAS, a celebrated woman, who was daughter of a king of Epirus, and who married Philip king of Macedonia, by whom she had Alexander the Great. Her haughtiness, and more probably her infidelity, obliged Philip to repudiate her, and to marry Cleopatra, the niece of King Attalus. Olympias was sensible of this injury, and Alexander showed his disapprobation of his father's measures, by retiring from the court to his mother. The murder of Philip, which soon followed this disgrace, and which some have attributed to the intrigues of Olympias, was productive of the greatest extravagances. The queen paid the greatest honour to her husband's murderer. She gathered his mangled limbs, placed a crown of gold on his head, and laid his ashes near those of Philip. The administration of Alexander, who had succeeded his father, was in some instances offensive to Olympias; but when the ambition of her son was concerned, she did not scruple to declare publicly that Alexander was not the son of Philip, but that he was the offspring of an enormous serpent who had supernaturally introduced himself into her bed. When Alexander was dead, Olympias seized the government of Macedonia; and, to establish her usurpation, she cruelly put to death Aridæus, with his wife Eurydice, as also Nicanor the brother of Cassander, with 100 leading men of Macedon, who were inimical to her interest. Such barbarities did not long remain unpunished: Cassander besieged her in Pydna, where she had retired with the remains of her family, and she was obliged to surrender after an obstinate siege. The conqueror ordered her to be accused, and to be put to death. A body of 200 soldiers were ordered to put the bloody commands into execution, but the splendour and majesty of the queen disarmed their courage; and she was at last massacred by those whom she had cruelly deprived of their children, about 316 years before the Christian era.

OLYMPIC GAMES, wese solemn games among the ancient Greeks, so called from Olympian Jupiter, to whom they were dedicated; and by some said to be first

first instituted by him, after his victory over the sons of Titan; others ascribe their institution to Hercules, not the son of Alcmena, but one of much greater antiquity; others to Pelops; and others to Hercules the son of Alcmena. By whomsoever they were instituted, we know that, at a period rather early, they had fallen into disuse. The wars which prevailed among the Greeks, for a while, totally interrupted the religious ceremonies and exhibitions with which they had been accustomed to honour the common gods and heroes; but the Olympic games were restored on the following occasion. Amidst the calamities which afflicted or threatened Peloponnesus, Iphitus, a descendant of Oxylus, to whom the province of Eleia * had fallen in the general partition of the peninsula, applied to the Delphic oracle. The priests of Apollo, ever disposed to favour the views of kings and legislators, answered agreeably to his wish, that the festivals anciently celebrated at Olympia, on the Alpheus, must be renewed, and an armistice proclaimed for all the states willing to partake of them, and desirous to avert the vengeance of heaven. Fortified by this authority, and assisted by the advice of Lycurgus, Iphitus took measures, not only for restoring the Olympic solemnity, but for rendering it perpetual. The injunction of the oracle, was speedily diffused through the remotest parts of Greece by the numerous votaries who frequented the sacred shrine. The armistice was proclaimed in Peloponnesus, and preparations were made in Eleia for exhibiting shows and performing sacrifices. In the heroic ages, feats of bodily strength and address were destined to the honour of deceased warriors; hymns and sacrifices were reserved for the gods: but the flexible texture of Grecian superstition, easily confounding the expressions of respectful gratitude and pious veneration, enabled Iphitus to unite both in his new institution.

* *Gillies's History of Greece.*

The festival, which lasted five days, began and ended with a sacrifice to Olympian Jove. The intermediate time was chiefly filled up by the gymnastic exercises, in which all freemen of Grecian extraction were invited to contend, provided they had been born in lawful wedlock, and had lived untainted by any infamous immoral stain. The preparation for this part of the entertainment was made in the gymnasium of Elis, a spacious edifice, surrounded by a double range of pillars, with an open area in the middle. Adjoining were various apartments, containing baths, and other conveniences for the combatants. The neighbouring country was gradually adorned with porticoes, shady walks and groves, interspersed with seats and benches; the whole originally destined to relieve the fatigues and anxiety of the candidates for Olympic fame; and frequented in later times, by sophists and philosophers, who were fond to contemplate wisdom, and communicate knowledge, in those delightful retreats. The order of the athletic exercises, or combats, was established by Lycurgus, and corresponded almost exactly to that described by Homer, in the 23d book of the Iliad, and eighth of the Odyssey. Iphitus, we are told, appointed the other ceremonies and entertainments; settled the regular return of the festival at the end of every fourth year, in the month of July; and gave to the whole solemnity that form and arrangement, which it preserved with little variation above a thousand years; a period exceeding the duration of the most famous kingdoms and republics of antiquity. Among the benefactors of Olympia, at a much later period, was reckoned Herod, who was afterwards king of Judæa. Seeing, on his way to Rome, the games neglected or dwindling into insignificance from the poverty of the Eleans, he displayed vast munificence as president, and provided an ample revenue for their future support and dignity.

The care and management of the Olympics belonged for the most part to the Eleans; who on that account enjoyed their possessions without molestation, or fear of war or violence. They appointed a certain number of judges, who were to take care that those who offered themselves as competitors should perform their preparatory exercises; and these judges, during the solemnity, sat naked, having before them a crown of victory, formed of wild olive, which was presented to whomsoever they adjudged it. Those who were conquerors were called *Olympionices*, and were loaded with honours by their countrymen. At these games women were not allowed to be present; and if any woman was found, during the solemnity, to have passed the river Alpheus, she was to be thrown headlong from a rock. This, however, was sometimes neglected; for we find not only women present at the celebration, but also some among the combatants, and some rewarded with the crown. The preparations for these festivals were great. No person was permitted to enter the lists, if he had not regularly exercised himself ten months before the celebration at the public gymnasium of Elis. No unfair dealings were allowed; whoever attempted to bribe his adversary was subjected to a severe fine; and even the father and relations were obliged to swear that they would have recourse to no artifice which might decide the victory in favour of their friends. No criminals, nor such as were connected with impious and guilty persons, were suffered to present themselves as combatants. The wrestlers were appointed by lot. Some little balls superscribed with a letter were thrown into a silver urn, and such as drew the same letter were obliged to contend one with the other. He who had an odd letter remained the last; and he often had the advantage, as he was to encounter the last who had obtained the superiority over his adversary. In these games were exhibited running, leaping, wrestling, boxing, and the throwing of the quoit, which was called altogether πενταθλον, or *quinquertium*. Besides these, there were horse and chariot races, and also contentions in poetry, eloquence, and the fine arts. The only reward that the conqueror obtained was a crown of olive. This, as some suppose, was in memory of the labours of Hercules, which were accomplished for the universal good of mankind, and for which the hero claimed no other reward but the consciousness of having been the friend of mankind. So small and trifling a reward stimulated courage and virtue, and was the source of greater honours than the most unbounded treasures. The statues of the conquerors, called *Olympionicæ*, were erected at Olympia in the sacred wood of Jupiter.

Their return home was that of a warlike conqueror; they were drawn in a chariot by four horses, and every where received with the greatest acclamations. Their entrance into their native city was not through the gates: to make it more grand and more solemn, a breach was made in the walls. Painters and poets were employed in celebrating their names; and indeed the

victories

victories severally obtained at Olympia are the subjects of the most beautiful odes of Pindar. The combatants were naked. A scarf was originally tied round their waste; but when it had entangled one of the adversaries, and been the cause that he lost the victory, it was laid aside, and no regard was paid to decency. The Olympic games were observed every fifth year, or, to speak with greater exactness, after a revolution of four years, and in the first month of the fifth year, and they continued for five successive days. As they were the most ancient and most solemn of all the festivals of the Greeks, it will not appear wonderful that they drew so many people, not only inhabitants of Greece, but of the neighbouring islands and countries.

Such is the account of Grecian writers, who have, doubtless, often ascribed to positive institution many inventions and usages naturally resulting from the progressive manners of society. When we come to examine the Elean games in their more improved state, together with the innumerable imitations of them in other provinces of Greece, there will occur reasons for believing, that many regulations, referred by an easy solution to the legislative wisdom of Iphitus or Lycurgus, were introduced by time or accident, continued through custom, improved by repeated trials, and confirmed by a sense of their utility *. Yet such an institution as the Olympiad, even in its least perfect form, must have been attended with manifest advantages to society. It is sufficient barely to mention the suspension of hostilities which took place, not only during the celebration of the festival, but a considerable time both before and after it. Considered as a religious ceremony, at which the whole Grecian name was invited, and even enjoined to assist, it was well adapted to facilitate intercourse, to promote knowledge, to soften prejudice, and to hasten the progress of civilization and humanity. Greece, and particularly Peloponnesus, was the centre from which the adventurous spirit of its inhabitants had diffused innumerable colonies through the surrounding nations. To these widely separated communities, which, notwithstanding their common origin, seemed to have lost all connexion and correspondence, the Olympiad served as a common bond of alliance and point of re-union. The celebrity of this festival continually attracted to it the characters most distinguished for genius and enterprise, whose fame would have otherwise been unknown and lost in the boundless extent of Grecian territory. The remote inhabitants, not only of European Greece, but of Asia and Africa, being assembled to the worship of common gods, were formed to the sense of a general interest, and excited to the pursuit of national honour and prosperity. Strangers of similar dispositions might confirm in Elis the sacred and indissoluble ties of hospitality. If their communities were endangered by any barbarous power, they might here solicit assistance from their Grecian brethren. On other occasions they might explain the benefits which, in peace or war, their respective countries were best qualified to communicate. And the Olympic festival might thus serve the purpose of resident ambassadors, and other institutions alike unknown to antiquity.

* *Gillies's History of Greece.*

OLYMPUS, the name of several mountains.—One bounding Bithynia on the south.—Another in the island of Cyprus, on whose top was a temple of Venus, which women were not permitted either to enter or to see (Strabo).—A third, Olympus of Galatia (Livy).—A fourth, of Lycia, with a noble cognominal town, near the sea coast (Strabo, Cicero), extinct in Pliny's time, there remaining only a citadel; the town was destroyed by P. Servilius Isauricus (Florus), having been the retreat of pirates. From this mountain there was an extensive prospect of Lycia, Pamphilia, and Pisidia (Strabo).—A fifth, Olympus of Mysia (Ptolemy); thence surnamed *Olympena*, anciently *Minor;* one of the highest mountains, and surnamed *Mysius* (Theophrastus;) situated on the Propontis, and thence extending more inland.—A sixth, on the north of Thessaly, or on the confines of Macedonia; famous for the fable of the giants (Virgil, Horace, Seneca); reckoned the highest in the whole world, and to exceed the flight of birds (Apuleius), which is the reason of its being called *heaven*, than which nothing is higher: the serenity and calmness which reign there are celebrated by Homer, Lucan, and Claudian.

OLYRA, a genus of plants belonging to the monœcia class; and in the natural method ranking under the 4th order, *Gramina*. See BOTANY *Index*.

OMAR EBN AL KHATTAB, successor of Abu Becr.—The Mohammedan imposture, like every other falsehood of its kind, copies after the truth as far as was thought convenient or proper; and miracles being the grand proof of revelation, it was to be expected that all pretences to that should assume at least the appearances of them. Few systems of faith are more absurd than Mohammed's; yet, though he disclaimed miracles, it was supported, as we are told by later writers, by a variety of them, which, however, unfortunately for the creed they were contrived to support, are too trifling, absurd, and contradictory, to deserve the smallest attention.

They tell us, but upon grounds too vague and indeterminate to command belief, that Omar was miraculously converted to this faith: a man he is reported to have been, before this event, truly respectable, and in particular a violent opposer of the Arabian prophet. Mohammed, it seems, felt this opposition, and regretted it; he therefore, with the fervour, and as it happened, with the success of a true prophet, according to his followers account, prayed for the conversion of this his dangerous antagonist. Omar, it is said, had no sooner read the 20th chapter of the Koran than he was convinced: upon which he instantly repaired to Mohammed and his followers, and declared his conversion. It is said, that at one time he intended to murder the prophet; and various causes are assigned for the prevention of this shocking piece of sacrilege. After his wonderful conversion, the Mohammedan writers inform us that he was surnamed *Al Faruk*, or the "divider;" because, say they, when a certain Moslem was condemned by Mohammed for his iniquitous treatment of a Jew, and appealed afterwards from the sentence of the prophet to Omar, he cut him in two with his scimitar for not acquiescing in the decision of so upright a judge: which circumstance when Mohammed heard, he gave him the surname of *Al Faruk*, or "the divider;" because, by this action, he had shown himself capable of perfectly distinguishing between truth and falsehood. Al Kodai affirms, that 39 of Omar's adherents followed his example the same day he professed himself a votary of Mohammed.

Omar. The conversion of Hamza and Omar Ebn Al Khattab happened in the year preceding the first flight of the Moslems into Ethiopia, or the fourth year of Mohammed's mission, according to Abulfeda. He was unquestionably a great acquisition to the prophet, and enabled him to carry on his schemes to far more purpose than he could possibly have done without him, or if he had continued his enemy. Omar at length found his services in the cause he had undertaken sufficiently honoured and amply rewarded; for on the death of Abu Becr, who had succeeded the impostor himself, he was promoted to the regal and pontifical dignity. The title first assigned him was the *caliph of the caliph of the apostle of God;* or in other words *the successor of the successor of Mohammed:* but the Arabs considering that this title, by the addition to be annexed to it at the accession of every future caliph, would be too long, they, by universal consent, saluted him *the emperor of the believers;* which illustrious title, at this juncture conferred on Omar, descended afterwards to all the successors of that prince. Our readers will not expect us to follow the caliph with minute exactness through the transactions of his reign. This would indeed swell our article beyond all proportion. We shall therefore confine ourselves to some of the leading facts.

His arms appear to have been particularly successful; the Persians he conquered, and Jerusalem submitted to his power; nor does he appear to have been checked in a single instance. In consequence, however, of his success, an attempt was made to assassinate him. The fact is thus related: Wathek Ebn Mosafer, a resolute young Arab, was procured by the king of Ghaffan, and sent to Medina for this very purpose. Some time after his arrival, observing Omar to fall asleep under a tree on which he had placed himself, so as not to be discovered by any person, he drew his dagger, and was upon the point of stabbing him, when, lifting up his eyes, he saw a lion walking round about him, and licking his feet. Nor did the lion cease to guard the caliph till he awoke; but then instantly went away. This phenomenon struck Wathek with a profound reverence for Omar, whom he now revered as the peculiar care of heaven. He therefore came down from the tree, on which the lion had forced him to remain, kissed the caliph's hand, confessed his crime, and embraced the Mohammedan religion; being so strongly affected with the wonderful deliverance he had been an eye witness of. His life, however, was at length ended by assassination; for about two years after the conclusion of the Nobawandian war, in which the Arabs probably still farther extended their conquests, though no account of their military operations during that period has reached us, that is in the 23d year of the Hegira, according to Abu Jaafar Al Tabari, the caliph Omar Ebn Al Khattab was assassinated by a Persian slave; of which horrid fact the Arab writers have handed down the following particulars: Abu Lulua, a Persian of the Magian sect, whose name was *Firuz*, one of Al Mogheira Ebn Al Shaabah's slave, was obliged by his master to pay daily two dirhems, in conformity to the Mohammedan custom, for the free exercise of this religion. Firuz resenting this treatment, complained of it to the caliph, and desired that some part at least of the tribute exacted of him might be remitted; but this favour being refused by Omar, the Persian threatened his destruction; which he soon after effected, by stabbing him thrice in the belly with a dagger, while he was in the mosque at Medina performing his morning devotions. The Arabs then present perceiving that the villain had imbrued his hands in the blood of their sovereign, immediately rushed upon him; but he made so desperate a defence, that he wounded 13 of the assailants, and seven of them mortally. At last one of the caliph's attendants threw his vest over him, and seized him; upon which he stabbed himself and soon after expired. According to Theophanes, this Firuz was an apostate or renegade, and consequently had before embraced the Mohammedan religion: but this assertion is by no means probable; because on his becoming a convert to Islamism, he must have been manumitted by his master, and on his relapsing into Magiism, he would have been put to death by the caliph's order: neither of which particulars are consistent with what we find related by the Arab historians, and even by our Greek chronographer himself. Omar languished three days and then died, in the month of Dhu'lhajja, and the 23d year of the Hegira, which began in the year of our Lord 643. Authors are not agreed with regard to the duration of his caliphate. The Arab historians, whom we are inclined to follow, say that he reigned between 10 and 11 years. Theophanes affirms, that he was murdered in the 12th year of his caliphate, and Dionysius Telmarensis extends the length of his reign to 12 complete years. Only one of the wounds given him by Firuz was mortal, and that he received under his navel. At his death he was 63 years old; which, as we are told by an Arab author, was the age of Mohammed himself, Abu Becr, and Ayesha, one of the prophet's wives, when they died. When Omar fell in the mosque, Abd'alrahman Ebn Awf, one of Mohammed's first converts, supplied his place during the remainder of the service; and three days before his death, Sahib Ebn Tarsib, at his command, officiated for him. His body was interred in Ayesha's apartment, near that of the prophet Mohammed. We are informed by Eutychius, that during his caliphate he performed the pilgrimage to Mecca nine times. His extensive conquests made the Moslem empire one of the most powerful and formidable monarchies in the world. His disposition is represented to us, with evident partiality indeed, as one of the best possible, and his temperance has always been highly extolled.

Omar, Ombi. OMBI, a city of ancient Egypt, afterwards called *Arsinoe* and *Crocodilopolis*, was the capital of one of the nomes into which that country was divided, and is remarkable, in the annals of idolatry, for the hatred of its inhabitants to the religion of their neighbours the citizens of Tentyra.

The genius of paganism was so complying with respect to the objects of religious worship, that although each nation, each city, and almost every family, had its own tutelar god, we know not a single instance, out of Egypt of one tribe of Pagans persecuting another for worshipping gods different from theirs. The Jews and Christians were indeed persecuted by the Romans, not however for worshipping the true God, but because, together with him, they would not worship Jupiter, Juno, and all the rabble of heathen divinities.

The reason of the almost universal tolerance of idolaters to one another, and of the intolerance of all to the

the Jews and Christians, is very obvious. Not a single Pagan, a very few philosophers perhaps excepted, ever thought of paying his adoration to the Supreme and self-existent Being, but to inferior divinities, to whom it was supposed that the care of particular persons, families, cities, and nations, was consigned by the God of the universe. The consequence was, that, as no person denied the divinity of his neighbour's object of worship, an intercommunity of gods was everywhere admitted, and all joined occasionally in adoring the gods of the various nations. By the Jews and Christians this communion was rejected as in the highest degree impious; and it could not well be maintained between the citizens of Ombi and those of Tentyra.

That brutes were worshipped in Egypt is universally known (see POLYTHEISM); and Diodorus the Sicilian informs us, in a passage quoted by Eusebius *, that "the cities and nomes of Egypt being at one time prone to rebellion, and to enter into conspiracies against monarchical government, one of their most politic kings contrived to introduce into the neighbouring nomes the worship of different animals; so that while each reverenced the deity which itself held sacred, and despised that which its neighbours had consecrated, they could hardly be brought to join cordially in one common design to the disturbance of the government."

* *Prep. Evang.* p. 32. Steph. ed.

In this distribution of gods he conferred upon Ombi the *crocodile*, and upon Tentyra, the mortal enemy of that monster, the *ichneumon*. The consequence of which was, that while the Ombites worshipped the crocodile, the Tentyrites took every opportunity of slaughtering him, insomuch that, according to Strabo, the very voice of an inhabitant of Tentyra put the crocodile to flight. This, we confess, is a very improbable fact; but it is certain that the mutual hatred of those cities, on account of their hostile gods, rose to such a height, that whenever the inhabitants of the one were engaged in the more solemn rites of their religion, those of the other were sure to embrace the opportunity of setting fire to their houses, and rendering them every injury in their power to inflict. And what may, to a superficial thinker, appear extraordinary, though it will excite no wonder in the breast of him who has studied mankind, this animosity continued between the inhabitants of the two cities long after the crocodile and ichneumon had lost their divinity.

The conduct of the Egyptian monarch was admirably calculated for preventing the nation from combining against the government; and it extended its influence over the whole kingdom. Diodorus informs us, that he assigned to each nome an animal to worship, which was hated, killed, and sometimes fed upon by the inhabitants of the neighbouring nome; and we know, upon higher authority than his, that the Israelites could not offer sacrifices in Egypt, because the bullock was deemed sacred over the whole country.

OMBRE, a celebrated game at cards, borrowed from the Spaniards, and played by two, by three, or by five persons, but generally by three. When three play at this game, nine cards are dealt to each party; the whole ombre pack being only 40: because the eights, nines, and tens, are thrown out of the pack. There are two sorts of counters for stakes, the greater and the lesser; the last having the same proportion to the other as a penny to a shilling: of the greater counters each man stakes one for the game; and one of the lesser for passing for the hand, when eldest, and for every card taken in. As to the order and value of the cards, the ace of spades, called *spadillo*, is always the highest trump, in whatsoever suit the trump be; the *manille*, or black duce, is the second; and the *basto*, or ace of clubs, is always the third: the next in order is the king, the queen, the knave, the seven, the six, the five, four, and three. Of the black there are 11 trumps; of the red, 12. The least small cards of the red are always the best, and the most of the black; except the duce and red seven, both of which are called the *manilles*, and are always second when the red is a trump. The red ace, when a trump, enters into the fourth place, and is called *punto;* otherwise it is only called an ace. The three principal cards are called *matadores;* which have this privilege, that they are not obliged to attend an inferior trump when it leads; but for want of a small trump, the person may renounce trumps, and play any other card; and when these are all in the same hand, the others pay three of the greater counters a-piece; and with these three for a foundation, he may count as many matadores as he has cards in an uninterrupted series of trumps; for all which the others are to pay one counter a-piece. He who hath the first hand is called *ombre*, and has his choice of playing the game, of naming the trump, and of taking in as many and as few cards as he pleases; and after him the second, &c. But if he does not name the trump before he looks on the cards he has taken in, any other may prevent him, by naming what trump he pleases. He that has the first hand should neither take in, nor play, unless he has at least three sure tricks in his hand: for, as he wins the game who wins most tricks, he that can win five of the nine has a sure game: which is also the case if he wins four, and can so divide the tricks as that one person may win two, and the other three.

If a person play without discarding or changing any cards, this is called *playing sans prendre;* and if another win more tricks than he, he is said to *win codille*. The oversights in the course of the game are called *beasts*. And if the ombre wins all the nine tricks, it is called *winning the vole*.

In ombre by five, which many, on account of its not requiring so close an attention, prefer to that by three, only eight cards a-piece are dealt; and five tricks must be won, otherwise the ombre is beasted. Here the person who undertakes the game, after naming the trump, calls a king to his assistance; upon which the person in whose hand the king is, without discovering himself, is to assist him as a partner, and to share his fate. If, between both, they can make five tricks, the ombre wins two counters, and the auxiliary king only one; but when the counters are even, they divide them equally. If the ombre venture the game without calling in any king, this too is called *playing sans prendre;* in which case the other four are all against him, and he must win five tricks alone, or be beasted. The rest is much the same as by three.

OMBRE *de soleil*, "Shadow of the sun," in *Heraldry*, is when the sun is borne in armory, so as that the eyes,

eyes, nose, and mouth, which at other times are represented, do not appear; and the colouring is thin, so that the field can appear through it.

OMBRIA, the ancient name of a province of Italy, in the territory of the pope, now called *Spoletto* and *Perugia*.

OMBRO, or LOMBRO, a town of Italy, in the duchy of Tuscany, and territory of the Siennois, situated near the Tuscan sea, a little south of the lake of Castiglione, 45 miles south-west of Sienna.

OMBROMETER, an instrument to measure the quantity of rain that falls. We have the description and figure of one in Phil. Trans. N° 473. p. 12. It consists of a tin funnel, whose surface is an inch square, with a flat board, and a glass tube set into the middle of it in a groove. The rise of the water in the tube, whose capacity at different times must be measured and marked, shews the quantity of rain that has fallen.

OMELET, or AMLET, a kind of pancake or fricassee of eggs, with other ingredients, very usual in Spain and France. It may be made as follows: The eggs being beaten, are to be seasoned with salt and pepper, and then fried in butter made boiling hot; this done, gravy is to be poured on, and the whole stewed with chives and parsley shred small: when one side is fried enough, it is to be turned on the other.

OMEN, is a word which, in its proper sense, signifies a sign or indication of some future event, taken from the language of a person speaking without any intent to prophecy. Hence Tully says, "Pythagorei non solum voces deorum observarunt, sed etiam hominum, quæ vocent *omina*;" "the Pythagoreans attend to the discourse not only of gods, but also of men, which they call *omens*." This sort of omen was supposed to depend much upon the will of the person concerned in the event; whence the phrases *accepit omen*, *arripuit omen*. Such were the original *omens*; but they were afterwards derived from *things* as well as from words. Thus Paterculus, speaking of the head of Sulpicius on the rostrum, says it was *velut omen imminentis proscriptionis*, "the omen of an impending proscription." Suetonius says of Augustus, that he believed implicitly in certain omens; and that, *si mane sibi calceus perperam, ac sinister pro dextero induceretur ut dirum*, "If his shoes were improperly put on in the morning, especially if the left shoe was put upon his right foot, he held it for a bad omen." Omen was used in a still larger sense, to signify an *augury*; as in the following line of Tully. "Sic aquilæ clarum firmavit Jupiter *omen*;" "thus Jove confirmed the bright omen of the eagle." It was lastly used, in the most generic sense of all, for a portent or prodigy; as in the third book of the Æneid, where a myrtle torn up by Æneas dropped blood. Upon this appearance, says the hero,

> ———Mihi frigidus horror
> Membra quatit, gelidusque coit formidine sanguis.

And the same thing being repeated upon his breaking a branch from another tree, he prayed to the gods to avert the *omen*.

> Multa movens animo Nymphas venerabar agrestes,
> Gradivumque patrem, Geticis qui præsidet arvis,
> Rite secundarent visus, *omen*que levarent (A.)

The portentous or supernatural omens were either external or internal. Of the former sort were those showers of blood so frequently occurring in the Roman history, which were much of the same nature with this adventure of Æneas, which he calls MONSTRA DEUM. Of the second sort were those sudden consternations, which, seizing upon men without any visible cause, were imputed to the agency of the god *Pan*, and hence called *panic fears*. But indeed there was hardly any thing, however trivial, from which the ancients did not draw omens. That it should have been thought a direful omen when any thing befel the temples, altars, or statues of the GODS, need excite no wonder; but that the meeting of a eunuch, a negro, a bitch with whelps, or a snake lying in the road, should have been looked upon as portending bad fortune, is a deplorable instance of human weakness, and of the pernicious influence of superstition on the mind.

It is more than probable that this practice of making ordinary events ominous of good or bad fortune took its rise in Egypt, the parent country of almost every superstition of paganism; but wherever it may have arisen, it spread itself over the whole inhabited globe, and at this day prevails in a greater or less degree among the vulgar of all nations.

In England, it is reckoned a good omen, or a sign of future happiness, if the sun shines on a couple coming out of the church after having been married. It is also esteemed a good sign if it rains whilst a corpse is burying:

> Happy is the bride that the sun shines on;
> Happy is the corpse that the rain rains on.

To

(A) Instead of translating those short quotations, we shall here give Dryden's version of the whole of this portentous adventure, as we are persuaded that the mere English reader, who alone can wish for a translation, will be glad to have the fullest account of the bleeding myrtle, together with its effects on the mind of the hero. It is as follows:

> Not far, a rising hillock stood in view;
> Sharp myrtles on the sides and corners grew.
> There, while I went to crop the sylvan scenes,
> And shade our altar with their leafy greens,
> I pull'd a plant (with horror I relate
> A prodigy so strange, and full of fate):
> The rooted fibres rose; and from the wound
> Black bloody drops distill'd upon the ground.
> Mute and amaz'd, my hair with terror stood;
> Fear shrunk my sinews, and congeal'd my blood.
> Mann'd once again, another plant I try;
> That other gush'd with the same sanguine dye.
> Then, fearing guilt for some offence unknown,
> With prayers and vows the Dryads I atone,
> With all the sisters of the woods, and most
> The god of arms, who rules the Thracian coast:
> That they, or he, these omens would avert,
> Release our fears, and better signs impart.

Omen.

To break a looking glass is extremely unlucky; the party to whom it belongs will lose his best friend.

If, going a journey on business, a sow cross the road, you will probably meet with a disappointment, if not a bodily accident, before you return home. To avert this you must endeavour to prevent her crossing you; and if that cannot be done, you must ride round on fresh ground. If the sow is attended with her litter of pigs, it is lucky, and denotes a successful journey.

It is unlucky to see first one magpye, and then more; but to see two denotes marriage or merriment; three, a successful journey; four, an unexpected piece of good news; five, you will shortly be in a great company. To kill a magpye, will certainly be punished with some terrible misfortune.

If in a family, the youngest daughter should be married before her elder sisters, they must all dance at her wedding without shoes: this will counteract their ill luck, and procure them husbands.

If you meet a funeral procession, or one passes by you, always take off your hat: this keeps all evil spirits attending the body in good humour.

If, in eating, you miss your mouth, and the victuals fall, it is very unlucky, and denotes approaching sickness.

It is lucky to put on a stocking the wrong side outwards: changing it alters the luck.

When a person goes out to transact any important business, it is lucky to throw an old shoe after him.

It is unlucky to present a knife, scissars, razor, or any sharp or cutting instrument, to one's mistress or friend, as they are apt to cut love and friendship. To avoid the ill effects of this, a pin, a farthing, or some trifling recompense, must be taken. To find a knife or razor, denotes ill luck and disappointment to the party.

In the Highlands of Scotland, it is thought unlucky if a person setting out upon a journey stumble over the threshold, or be obliged to return for any thing forgotten. If a sportsman see any person stepping over his gun or fishing rod, he expects but little success in that day's diversion. *Sneezing* is also deemed ominous. If one sneeze when making a bed, a little of the straw or heath is taken out and thrown into the fire, that nothing may disturb the rest of the person who is to sleep in the bed. Among the same people, success in any enterprise is believed to depend greatly upon the first creature that presents itself after the enterprise is undertaken. Thus, upon going to shoot, it is reckoned lucky to meet a horse, but very unfortunate to see a hare, if she escape; and upon meeting any creature deemed unlucky, the best means of averting the omen is to roll a stone towards it. The Greeks attributed the same efficacy to the rolling of a stone, though they greatly preferred *killing* the ominous animal, that the evil portended might fall on its own head*.

The motions and appearances of the clouds were not long ago considered as certain signs by which the skilful Highlander might attain to the knowledge of futurity. On the evening before *new year's day*, if a black cloud appeared in any part of the horizon, it was thought to prognostic a plague, a famine, or the death of some great man in that part of the country over which it should appear to set; and in order to ascertain the place threatened by the omen, the motions of this cloud were often watched through the whole night, if it happened to continue so long visible above the horizon.

By the believers in this superstition there are days, as well as words and events, which are deemed ominous of good or bad fortune. The first day of every quarter, midsummer, and new year's day, are reckoned the most fortunate days in the year for accomplishing any design. In the isle of Mull, ploughing, sowing, and reaping, are always begun on *Tuesday*, though the most favourable weather for these purposes be in this way frequently lost. That day of the week on which the third of May falls, is deemed unlucky throughout the whole year. In Morven, none will upon any account dig peat or turf for fuel on *Friday*; and it is reckoned unlucky to number the people or cattle belonging to any family, and doubly so if the number be taken on Friday. The age of the moon is also much attended to by the vulgar Highlanders. It is alleged, that during the increase things have a tendency to grow and stick together: and hence, in the isle of Sky, fences which are there made of turf, are built only at that time; whilst turf or peat for fuel are never, even in the most favourable weather, either made or stacked up but while the moon is in its wane. An opinion prevails in some places, that if a house take fire during the increase of the moon, the family to which it belongs will prosper in the world: but that if the fire happen while the moon is in the decrease, the family will from that time decline in its circumstances, and sink into poverty.

In attributing such influence to the moon, the superstitious Highlanders have the honour to agree with the philosophic Virgil, who in his Georgics gives the following sage instructions to the husbandman:

Ipsa dies alios alio dedit ordine Luna
Felices, operum. Quintam fuge:
* * * *

Septima post decimam felix et ponere vitem,
Et prensos domitare boves, et licia telæ
Addere: nona fugæ melior, contraria furtis.

The lucky days in each revolving moon
For labour choose: the *fifth* be sure to shun.
* * * *

The *seventh* is, next the *tenth*, the best to join
Young oxen to the yoke, and plant the vine.
Then weavers stretch your stays upon the weft:
The *ninth* is good for travel, bad for theft.

DRYDEN.

From this coincidence of the superstition of the Roman poet with that of the natives of Mull and Morven, we are strongly inclined to adopt the hypothesis of the gentlemen who favoured us with this accurate account of Highland omens. He justly observes, that this superstitious practice of auguring good or ill from trifling events, and from the particular phases of the moon, has no connexion whatever with popish priestcraft: he shows that the Romish clergy, even in the darkest age, were at pains to eradicate it as idle and impious; and he therefore infers that it must be a relick of Druidism handed down by tradition from an era prior to the introduction of Christianity into the Highlands and isles of Scotland. That the Druids were

* See Potter's *Antiquities*, vol. i. p. 346.

were acquainted with the particular doctrines of Pythagoras has been shown elsewhere (see DRUIDS); that Virgil was no stranger to the Pythagorean philosophy is known to every scholar; that Pythagoras and his followers were addicted to the dotages of MAGIC has been made apparent in that article; and therefore it appears to us probable at least, that the attention paid to pretended omens, not only in the Highlands, but also in the low country of Scotland, and indeed among the vulgar in every country of Europe, is a remnant of one of the many superstitions which the Druids imposed upon their deluded followers. That it is contrary to every principle of sound philosophy, all philosophers will readily acknowledge; and whoever has studied the writings of St Paul must be convinced that it is inconsistent with the spirit of genuine Christianity.

OMENTUM, or EPIPLOON, the *Cawl*, in *Anatomy*, a membranaceous part, usually furnished with a large quantity of fat; being placed under the peritonæum, and immediately above the intestines. See ANATOMY, Nº 90.

OMER, in Jewish antiquity. See CORUS.

ST OMER's, a strong, fortified, large, town of France, in the department of the Straits of Calais, with a castle and a bishop's see, and containing 20,109 inhabitants in 1800. It is a fortress of considerable importance, surrounded on one side with a large morass; and about it there are many sluices, which serve to carry the water off when it is overflowed. In the midst of the morass there is a sort of floating islands covered with verdure and trees. The cathedral is a handsome structure; and there are other fine buildings, with a rich Benedictine abbey. The French became masters of this place in 1679. It is seated on the river Aa, and on the side of a hill, eight miles north-west of Aire, and 135 north of Paris. E. Long. 2. 20. N. Lat. 54. 45.

OMOA, a Spanish town and fortification on the south side of the bay of Honduras, N. Lat. 15. 50. W. Long. 89. 50. from London. It is the key to the bay; and such is the depth of the water, that ships of any burden may ride in the harbour with safety. It is a place of the utmost importance to Spain, as the register ships to and from Guatimala are sent to it in the time of war. The town was first established in 1751, under the command of Don Joseph Antonio de Palmo. At that period the inhabitants were about 20 white men, 60 mulattoes and free negroes, and 200 slaves to the king of Spain; and the military force consisted of about 30 soldiers, besides officers. The fort was originally composed of sand confined in boarded coffers, and faced with half-burnt bricks. It was defended by 12 fine brass 24 pounders mounted, four or five iron guns of different bores, and some field-pieces. The Spaniards, sensible of the importance of the place, afterwards fortified it at an incredible expence, the stone of which the walls are built having been raised from the sea, and brought from the distance of 20 leagues. The outworks were not completely finished in the year 1779, though 1000 men had then been employed upon them for 20 years.

Towards the end of that year an expedition was undertaken against this fortress, in consequence of one formed by the Spaniards against the British logwood cutters in the bay of Honduras and on the Mosquito shore. The latter, finding themselves hard pressed by their enemies, applied to General Dulling governor of Jamaica for assistance; who accordingly sent a detachment to their relief under Captain Dalrymple, with necessary supplies of arms, ammunition, and artillery. Before their arrival, however, the Spaniards had taken possession of St George's Key, the chief settlement of the British in these parts, which they plundered, and took a number of prisoners; but those who escaped, being joined by a body of their countrymen, retook it, and forced the enemy to retire. In the mean time Captain Dalrymple, who had been informed of the loss of the place, was hastening to the relief of the inhabitants, and in his way fell in with Admiral Parker, who was in quest of some register ships; but which, retreating into the harbour of Omoa, were too strongly protected by the fort there to be attacked by sea. As the Spaniards, however, had now been compelled to abandon St George's Key, it was proposed to unite the British forces by sea and land, and to attempt the conquest of this fortress. As the force under Captain Dalrymple was too inconsiderable to attempt the fort by land, it was augmented by the marines of the squadron and a strong party of the settlers; though, after all, it did not exceed the number of the garrison who opposed them.

The troops were landed at about nine miles distance from the fort in the dusk of the evening, with a design to march directly forward, in order to surprise and carry it by escalade in the night time. No roads, however, being found, they were obliged to explore their way through narrow foot-paths, morasses, and over mountains so beset with precipices, that they were obliged, in order to avoid them, to make use of lights made of the cabbage tree. In consequence of these impediments they were yet at a considerable distance from the fort, when the approach of day discovered them to the enemy. An engagement ensued, in which the Spaniards were quickly routed and driven into the town: from whence as they continued to fire upon the British, it was found necessary to set fire to it, though very much against the inclination of the assailants.

In the mean time the squadron took the opportunity, while the town was in flames, to come into the bay, and approach the fort with an intention to batter it; but the garrison returned the fire so briskly, that no impression could be made by that of the squadron, which was detained by want of wind from approaching sufficiently near. The troops then, being masters of the ground adjacent to the fort, erected several batteries in such situations as were most proper for annoying it; but though they carried on their operations with great vigour, it was still found that heavier artillery than any they possessed would be requisite, the walls being no less than 18 feet in thickness; in consequence of which they resolved still to attempt the place by escalade.

The attempt was made on the 21st of October, early in the morning. The troops entered the ditch, which fortunately for them happened to be dry, and fixed their scaling ladders against the walls, which were near 30 feet high. Two seamen mounted first; and, with admirable courage and presence of mind, stood by the ladder which they had mounted, to guard it till others ascended;

ed; and boldly presented their pieces against a large party drawn up to receive them, though they prudently retained their fire till their comrades came up.

The squadron, now drawing near, kept up a heavy and continual fire upon the fort, while the Spaniards were struck with such surprise at the excessive celerity and boldness of the assailants, that they remained motionless and unable to oppose their enemies, notwithstanding the exhortation and example of their officers. From this panic they never recovered; and while the seamen and soldiers continued to scale the walls with amazing quickness, the Spaniards never made any effort to defend themselves. About 100 of them escaped over the walls on the opposite side of the fort; the remainder surrendered at discretion.

The whole of this transaction reflected the highest lustre both on the conduct and courage of the British; and an instance of heroism is related in a British sailor to which history affords nothing superior. This man, having scaled the walls, had armed himself with a cutlass in each hand. Thus armed, he met with a Spanish officer unarmed, and just roused from sleep. The generous tar scorned to take advantage of his condition, and therefore presented him with one of his own cutlasses saying, "You are now on a footing with me!" The officer, however, was too much struck with admiration at his conduct to accept the offer, and took care to make the circumstance sufficiently known.—The value of the booty taken on this occasion amounted to three millions of dollars; but the loss most sensibly felt by the Spaniards was that of 250 quintals of quicksilver, a commodity indispensably necessary in extracting the precious metals from their ores. They offered therefore to ransom it at any price: but though the retention of it was far from affording a profit equal to that offered by the Spaniards, the British commanders absolutely refused to part with it, on account of the advantages the enemy would derive from having the metal in their possession. For the same reason they refused to accept of any ransom for the fort, though the governor offered to lay down 300,000 dollars for it. The Spanish military and the inhabitants were treated with the utmost humanity; their personal effects remaining untouched; and this generosity must have appeared to greater advantage, when contrasted with the behaviour of their own countrymen at Honduras, where the British were treated with remarkable severity. The church plate and ornaments were restored, on condition that the terms of capitulation should be faithfully kept.

In a short time, however, it appeared that it would have been better to have accepted of a ransom for the fort, as from circumstances at that time it could not be retained in the possession of Britain. A garrison was indeed left for its defence on the departure of the British squadron; but as it was very inconsiderable, on account of the small number of men that could be spared, the Spaniards quickly determined to make an attempt to regain the fort. For this purpose a body of 2000 men were collected, who invested it on the 25th of November. The British defended it with the utmost bravery; keeping up a constant fire on the enemy, and obliging them to retire for shelter, and take up their quarters behind a hill. Here they made preparations for an assault, in which their numbers left the success, as they supposed, by no means dubious. The garrison was therefore summoned to surrender, with a promise of the honours of war and a safe conveyance to Great Britain, denouncing at the same time the utmost vengeance in case of a refusal; which being refused, the necessary preparations were made for an escalade.

The condition of the garrison was now such as could afford very little hope of being able to make any effectual resistance. They were but 85 in number, most of whom were become incapable of duty either from illness or excessive fatigue. They were now also obliged to make one centinel answer for five, by shifting his place, and challenging as many times. There was no surgeon to attend the sick and wounded; nor had they even any water but what came from a sloop of war that lay abreast of the fort. In this desperate situation, they resolved, notwithstanding the menaces of the Spanish commander to render the place as unserviceable as they could. For this purpose they spiked up all the guns; destroying the stores and ammunition that could not be carried off: they even locked the gates of the fort, after which they embarked without the loss of a single man. All this was performed in defiance of the large force that besieged them; and the exploit, when duly considered, must appear not less a matter of astonishment than the extraordinary manner in which the fort had been taken. The officer who commanded in this remarkable retreat was Captain Hulke of the navy.

OMOPHAGIA, an ancient Greek festival, in honour of Bacchus, surnamed *Omophagos*, i. e. eater of raw flesh. This festival was observed in the same manner with the other festivals of Bacchus, in which they counterfeited madness. What was peculiar to it, was, that the worshippers used to eat the entrails of goats, raw and bloody, in imitation of the god, who was supposed to do the same thing.

OMPHACINE OIL, a viscous brown juice extracted from green olives. With this oil the ancient *athletæ*, when going to wrestle, anointed themselves; and when that gymnastic exercise was over, they rolled themselves in the sand, which, mixing with the oil and sweat on their bodies, constituted the *strigmenta* so highly esteemed in the cure of several diseases. This precious medicine was carefully scraped off the body of the athleta with a kind of instrument something like a comb, which was called *strigilis;* and such was the demand for the scrapings, that they were a very lucrative article of trade.

OMPHALE, in fabulous history, a queen of Lydia, daughter of Jardanus. She married Tmolus, who at his death left her mistress of his kingdom. Omphale had been informed of the great exploits of Hercules, and wished to see so illustrious a hero. Her wish was soon gratified. After the murder of Eurytus, Hercules fell sick, and was ordered to be sold as a slave, that he might recover his health and the right use of his senses. Mercury was commissioned to sell him, and Omphale bought him, and restored him to liberty. The hero became enamoured of his mistress, and the queen favoured his passion, and had a son by him, whom some call Agelaus and others Lamon. From this son were descended Gyges and Crœsus; but this opinion is different from the account which makes these Lydian monarchs spring from Alcæus, a son of Hercules, by one of the female servants of Omphale. Hercules is represented by the poets as so desperately enamoured of the queen, that, to conciliate her esteem, he spins by her side among her women, while she covers herself with the lion's skin, and arms herself with the club of the hero, and often strikes him with her sandals, for the uncouth manner with which he holds the distaff, &c. Their fondness was mutual. As they once travelled together, they came to a grotto on Mount Tmolus, where the queen dressed herself in the habit of her lover, and obliged him to appear in a female garment. After they had supped, they both retired to rest in different rooms, as a sacrifice on the morrow to Bacchus required. In the night Faunus, or rather Pan, who was enamoured of Omphale, introduced himself into the cave. He went to the bed of the queen, but the lion's skin persuaded him that it was the dress of Hercules; and therefore he repaired to the bed of Hercules, in hopes to find there the object of his affections. The female dress of Hercules deceived him, and he laid himself down by his side. The hero was awakened, and kicked the intruder into the middle of the cave. The noise awoke Omphale, and Faunus was discovered lying on the ground, greatly disappointed and ashamed.

OMPHALEA, a genus of plants belonging to the monœcia class; and in the natural method ranking with those of which the order is doubtful. See BOTANY *Index*.

OMPHALO-MESENTERIC, in *Anatomy*. All fœtuses are wrapped up in at least two coats or membranes; most of them have a third, called *allantoides*, or *urinary*.

Some, as the dog, cat, hare, &c. have a fourth, which has two blood-vessels, viz. a vein and an artery, called *omphalo-mesenterics*, because passing along the string to the navel, and terminating in the mesentery.

OMRAH, a man of the first rank in the Mogul empire; a nobleman. It is the plural of the Arabic *ameer*.

ON, in *Ancient Geography*, a city of Egypt sacred to the sun, and by the Greeks, on that account, called *Heliopolis*. (See HELIOPOLIS). It was remarkable for the wisdom and learning of its priesthood, and for the spacious building in which they cultivated the studies of philosophy and astronomy. The priests of On were esteemed more noble than all the other priests of Egypt. They were always privy counsellors and ministers of state; and therefore, when Pharaoh resolved to make Joseph *prime* minister, he very wisely gave him in marriage a daughter of the priest of *On*, thereby incorporating him into the most venerable cast in Egypt. Bishop Warburton thinks that the superior nobility of the priests of *On* was chiefly owing to their high antiquity and great learning. That they were much given to the study of astronomy, we know from the testimony of Strabo; and indeed nothing is more probable than that they should be attached to the study of that system over which their god, the SUN, presided, not only in his *moral* but also in his *natural* capacity. The learned prelate affirms, that "whether they received the doctrine from original tradition, or invented it at hazard (which last supposition he thinks more probable, though we are of a very different opinion), it is certain they taught that the Sun is in the centre of its system, and that all the other bodies move round it in perpetual revolutions. This noble theory (he continues) came with the rest of the Egyptian learning into Greece (being brought thither by Pythagoras, who received it from Oenuphis *, a priest of *On*); and after having given the most distinguished lustre to his school, it sunk into obscurity, and suffered a total eclipse throughout a long succession of learned and unlearned ages; till these times restored its ancient splendour, and immoveably fixed it on the unerring principles of science."

* *Plut. de Is. et Osir.* p. 632. Steph. ed.

If it be true, as some philosophers allege, that Moses appears from the first chapter of Genesis to have been acquainted with the true solar system, this account of the origin of that system is extremely probable. As it is of no importance to the civil or religious constitution of a state whether the system of Ptolemy or that of Copernicus be admitted by the people, we cannot reasonably suppose that the Jewish lawgiver was taught astronomy by a revelation from Heaven. But there can be no doubt of his knowing as much of that science as the priests of *On*; for we know that he was instructed in all the wisdom of the Egyptians; and therefore, if he held the sun to be in the centre of the system, it is morally certain that the same thing was held by that priesthood.

ONANIA, or ONANISM, terms employed to denote the crime of self-pollution, mentioned in Scripture to have been committed by Onan, and punished in him with death.

This practice, however common, hath among all nations been reckoned a very great crime. In Scripture, besides the instance of Onan above mentioned, we find self-polluters termed *effeminate*, *unclean*, *filthy*, and *abominable*. Even the heathens, who had not the advantage of revelation, were of the same opinion, as appears from the following lines of Martial.

Hoc nihil esse putes! scelus est, mihi crede; sed ingens
Quantum vix animo concipis ipse tuo.

You think 'tis nothing! 'tis a crime, believe!
A crime so great you scarcely can conceive.

Dr Tissot has published a treatise on the pernicious effects of this shameful practice, which appears to be no less baneful to the mind than to the body. He begins with observing, that, by the continual waste of the human body, aliments are required for our support. These aliments, however, require certain preparations in the body itself; and when by any means we become so altered that these preparations cannot be effected, the best aliments then prove insufficient for the support of the body. Of all the causes by which this morbid alteration is brought on, none is more common than too copious evacuations; and of all evacuations, that of the semen is the most pernicious when carried to excess. It is also to be observed, that though excess in natural venery is productive of very dangerous disorders, yet an equal evacuation by self-pollution, which is an unnatural way, is productive of others still more to be dreaded. The consequences enumerated by Dr Tissot are as follow:

1. All the intellectual faculties are weakened; the memory fails; the ideas are confused, and the patient sometimes

sometimes even falls into a slight degree of insanity. They are continually under a kind of inward restlessness, and feel a constant anguish. They are subject to giddiness; all the senses, especially those of seeing and hearing, grow weaker and weaker, and they are subject to frightful dreams.

2. The strength entirely fails, and the growth in young persons is considerably checked. Some are afflicted with almost continual watching, and others dose almost perpetually. Almost all of them become hypochondriac or hysteric, and are afflicted with all the evils which attend these disorders. Some have been known to spit calcareous matters; and others are afflicted with coughs, slow fevers, and consumptions.

3. The patients are affected with the most acute pains in different parts of the body, as the head, breast, stomach, and intestines; while some complain of an obtuse sensation of pain all over the body on the slightest impression.

4. There are not only to be seen pimples on the face, which are one of the most common symptoms; but even blotches, or suppurative pustules, appear on the face, nose, breast, and thighs; and sometimes fleshy excrescences arise on the forehead.

5. The organs of generation are also affected; and the semen is evacuated on the slightest irritation, even that of going to stool. Numbers are afflicted with an habitual gonorrhœa, which entirely destroys the vigour of the constitution, and the matter of it resembles a fetid sanies. Others are affected with painful priapisms, dysuries, stranguries, and heat of urine, with painful tumours in the testicles, penis, bladder, and spermatic cord; and impotence in a greater or less degree is the never-failing consequence of this detestable vice.

6. The functions of the intestines are sometimes totally destroyed; and some patients complain of costiveness, others of diarrhœa, piles, and the running of a fetid matter from the fundament.

With regard to the cure, the first step is to leave off those practices which have occasioned the disease; which our author asserts is no easy matter; as, according to him, the soul itself becomes polluted, and can dwell on no other ideas; or if she does, the irritability of the parts of generation themselves quickly recal ideas of the same kind. This irritability is no doubt much more to be dreaded than any pollution the soul can have received; and by removing it, there will be no occasion for exhortations to discontinue the practice. The principal means for diminishing this irritability are, in the first place, to avoid all stimulating, acrid, and spiced meats. A low diet, however, is improper, because it would further reduce the body, already too much emaciated. The food should therefore be nutritive, but plain, and should consist of flesh rather roasted than boiled, rich broths, &c.

ONCA and ONCE. See FELIS, MAMMALIA *Index*.

ONEEHOURA and ONEEHOW, two small islands of that cluster which was discovered by Captain Cook, and by him called the *Sandwich Islands*. (See SANDWICH ISLANDS). *Oneehoura* is very small, and its chief produce is yams. *Oneehow* is considerably larger, being about ten miles over. It is remarkable for the great quantity of excellent yams which it produces, and for a sweet root called *tee* or *tea*, which is generally about the thickness of a man's wrist, though sometimes much larger. This root, which the natives commonly bake previous to their bringing it to market, is of a wet clammy nature, and with proper management makes excellent beer.

ONEGA, a river and lake of the Russian empire, between Muscovite Carelia, the territory of Cargapol, and Swedish Carelia. It is 100 miles in length and 40 in breadth, having a communication with the lake Ladoga, and consequently with Petersburgh. The river, which has its source in Cargapol, and gives its name to a country full of woods, falls into the White sea.

ONEGLIA, a sea-port town of Italy, in the territory of Genoa, with the title of a principality; but belonging to the king of Sardinia, as well as the province, which abounds in olive trees, fruit, and wine. It has often been taken and retaken in the wars of Italy, being an open place. It was taken by the French in 1794, and united to the republic, forming a part of the department of Stura. In 1814 it was restored to Sardinia. E. Long. 7. 51. N. Lat. 43. 58.

ONEIROCRITICA, the art of interpreting dreams; or a method of foretelling future events by means of dreams. See DREAM, DIVINATION, &c.—The word is formed from the Greek ονειρος, "dream," and κριτικη, of κρισις, judgment." Some call it *oneirocratica*; and derive it from ονειρος and κρατεω, "I possess, I command."

It appears from several passages of Scripture, that there was, under the Jewish dispensation, such a thing as foretelling future events by dreams; but then there was a particular gift or revelation required for that purpose.

Hence it has been inferred, that dreams are really significative, and do forebode something to come; and all that is wanting among us is the *oneirocritica*, or the art of knowing what; yet it is the opinion of many, that dreams are mere chimeras; bearing indeed some relation to what has passed, but none to what is to come. As to the case of Joseph, it was possible for God, who knew all things, to discover to him what was in the womb of fate; and to introduce that, he might take the occasion of a dream.

ONEIROCRITICS, a title given to interpreters of dreams, or those who judge of events from the circumstances of dreams.

There is no great regard to be had to those Greek books called *oneirocritics*; nor do we know why the patriarch of Constantinople, and others, should amuse themselves with writing on so pitiful a subject.

Rigault has given us a collection of the Greek and Latin works of this kind; one attributed to Astrampsichus; another to Nicephorus, patriarch of Constantinople; to which are added the treatises of Artemidorus and Achmet. But the books themselves are little else than reveries; a kind of waking dreams, to explain and account for sleeping ones.

The secret of oneirocriticism, according to them all, consists in the relation supposed to be between the dream and the thing signified; but they are far from keeping to the relations of agreement and similitude; and frequently have recourse to others of dissimilitude and contrariety. Concerning oneirocritics and oneirocritica;

rocritica, the unlearned reader will find much information in Warburton's Divine Legation of Moses, and the books to which he refers.

ONESIÆ THERMÆ, were, according to Strabo, *excellent baths*, and *salutary waters*, at the foot of the Pyrenees in Aquitania. Near the river Aturus stands at this day the town Bagneres, famous for its waters, which appear to be the *Onesiæ* of Strabo: situated in the county of Bigorre in Gascony, near the river Adour.

ONIÆ OPPIDUM and *Templum* (Josephus); so called from Onias, the high-priest of the Jews in Egypt; who built a temple in imitation of that at Jerusalem, by permission of the king of Egypt, on the spot where stood the temple of Diana Agrestis in Leontopolis: it was encompassed with a brick wall, and had a large tower like that at Jerusalem (Josephus); it was the metropolis of the Nomos Heliopolites, (Ptolemy); because in Strabo's time Heliopolites was fallen to decay.

ONGLEE, in *Heraldry*, an appellation given to the talons or claws of beasts or birds when borne of a different colour from that of the body of the animal.

ONION. See ALLIUM, BOTANY *Index*; and for the mode of its cultivation, see GARDENING *Index*.

ONISCUS, a genus of insects belonging to the order of aptera. See ENTOMOLOGY *Index*.

ONKELOS, surnamed the *Proselyte*, a famous rabbi of the first century, and the author of the Chaldee Targum on the Pentateuch. He flourished in the time of Jesus Christ, according to the Jewish writers; who all agree that he was, at least in some part of his life, contemporary with Jonathan Ben Uzziel, author of the second Targum upon the prophets. Dean Prideaux thinks he was the elder of the two, for several reasons: the chief of which is the purity of the style in his Targum, therein coming nearest to that part of Daniel and Ezra which is in the Chaldee, and is the truest standard of that language, and consequently is the most ancient; since that language, as well as others, was in a constant flux, and continued deviating in every age from the original: nor does there seem to be any reason why Jonathan Ben Uzziel, when he undertook his Targum, should pass over the law, and begin with the prophets, but that he found Onkelos had done this work before him, and with a success which he could not exceed.

Azarias, the author of a book entitled *Meor Enaim*, or the *light of the eyes*, tells us, that Onkelos was a proselyte in the time of Hillel and Samnai, and lived to see Jonathan Ben Uzziel one of the prime scholars of Hillel. These three doctors flourished 12 years before Christ, according to the chronology of Gauz; who adds, that Onkelos was contemporary with Gamaliel the elder, St Paul's master, who was the grandson of Hillel, who lived 28 years after Christ, and did not die till 18 years before the destruction of Jerusalem. However, the same Gauz, by his calculation, places Onkelos 100 years after Christ; and to adjust his opinion with that of Azarias, extends the life of Onkelos to a great length. The Talmudists tell us that he assisted at the funeral of Gamaliel, and was at a prodigious expence to make it most magnificent. Dean Prideaux observes, that the Targum of Onkelos is rather a version than a paraphrase; since it renders the Hebrew text word for word, and for the most part accurately and exactly, and is by much the best of all this sort: and therefore it has always been held in esteem among the Jews much above all the other Targums: and being set to the same musical notes with the Hebrew text, is thereby made capable of being read in the same tone with it in their public assemblies.—From the excellency and accuracy of Onkelos's Targum, the dean also concludes him to have been a native Jew, since without being bred up from his birth in the Jewish religion and learning, and long exercised in all the rites and doctrines thereof, and being also thoroughly skilled in both the Hebrew and Chaldee languages, as far as a native Jew could be, he can scarce be thought thoroughly adequate to that work which he performed; and that the representing him as a proselyte seems to have proceeded from the error of taking him to have been the same with Akilas, or Aquila, of Pontus, author of the Greek Targum or version of the prophets and Hagiographia, who was indeed a Jewish proselyte.

ONOCLEA, a genus of plants belonging to the cryptogamia class and order of *Filices*. See BOTANY *Index*.

ONOMANCIA, or rather ONOMANTIA, a branch of divination, which foretels the good or bad fortune of a man, from the letters in his name. See the article DIVINATION and NAME.

From much the same principle the young Romans toasted their mistresses as often as there were letters in their names: Hence Martial says,

Nævia sex cyathis, septem Justina bibatur.

ONOMATOPOEIA, in grammar and rhetoric, a figure where words are formed to resemble the sound made by the things signified; as the buzz of bees, the cackling of hens, &c. Resemblances of this kind are often fancied when they are not real, though, no doubt, there are in every language some words of which the sound is very like to that which those words are employed to express. Yet, to the mortification of grammarians and rhetoricians, conjunctions, which have been justly pronounced no parts of speech, are the only sounds uttered by men that are wholly natural, and these are fewer than is commonly supposed. See GRAMMAR and LANGUAGE.

ONONIS, a genus of plants, belonging to the diadelphia class. See BOTANY *Index*.

ONOPORDUM, a genus of plants belonging to the syngenesia class; and in the natural method ranking under the 49th order, *Compositæ*. See BOTANY *Index*.

ONOSANDER, a Greek author and Platonic philosopher, who wrote Commentaries on Plato's Politics, which are lost: but his name is particularly famous for a treatise entitled Λογος Στρατηγικος, "Of the duty and virtues of the general of an army;" which has been translated into Latin, Italian, Spanish, and French. The time when he lived is not precisely known; but is imagined to be in the reign of the emperor Claudius.

ONOSMA, a genus of plants, belonging to the pentandria class; and in the natural method ranking under the 41st order, *Asperifoliæ*. See BOTANY *Index*.

ONTARIO, a lake of North America, in the country of the Iroquois, 160 miles in length, and from 60 to 70 in breadth. Many rivers run into this lake: and the

the great river St Lawrence passes through it. It is the lowest of the great chain of American lakes, and contains 19 islands, most of them small.

ONTOLOGY. See METAPHYSICS, N° 3.

ONYCOMANCY, or, as some write it, ONYMANCY; a kind of divination by means of the nails of the fingers.——The word is formed from the Greek ονυξ, "nail," and μαντεια, "divination."

The ancient practice was to rub the nails of a youth with oil and soot, or wax; and to hold up the nails thus smeared against the sun.—Upon them were supposed to appear figures or characters, which showed the thing required.

ONYX, a mineral substance ranked among gems, which derives its name from the colour resembling that of the nail of the finger. See CARNELIAN, under MINERALOGY, p. 167.

OONALASHKA, one of the islands of the Northern Archipelago, visited by Captain Cook in his last voyage. The native inhabitants of this island are, to all appearances, a very peaceable people, having been much polished by the Russians, who now keep them in a state of subjection. As the island furnishes them with subsistence, so it does, in some measure, with clothing, which is chiefly composed of skins. The upper garment, which is made like a waggoner's frock, reaches down to the knees. Besides this, they wear a waistcoat or two, a pair of breeches, a fur cap, and a pair of boots, the legs of which are formed of some kind of strong gut; but the soles and upper-leathers are of Russia leather. Fish and other sea animals, birds, roots, berries, and even sea weed, compose their food. They dry quantities of fish during the summer, which they lay up in small huts for their use in winter. They did not appear to be very desirous of iron, nor to want any other instrument, except sewing needles, their own being formed of bone. With these they sew their canoes, and make their clothes, and also work their curious embroidery. They use, instead of thread, the fibres of plants, which they split to the thickness required. All sewing is performed by the females, who are shoemakers, tailors, and boat-builders. They manufacture mats and baskets of grass, which are both strong and beautiful. There is indeed a neatness and perfection in most of their works, that shows they are deficient neither in ingenuity nor perseverance.

Though the climate is sometimes severe, Captain Cook did not observe a fire-place in any of their habitations. They are lighted as well as heated by lamps; which, though simple, effectually answer the purpose for which they are intended. They consist of a flat stone, hollowed on one side like a plate; in the hollow part they put the oil, mixed with some dry grass, which serves for a wick. Both sexes often warm themselves over one of these lamps, by placing it between their legs, under their garments, and sitting thus over it for several minutes. W. Long. 163. 29. N. Lat. 53. 5.

OONELLA, and OONEMAH, two islands of the same archipelago with Oonalashka; the former of which lies to the north-east of that island, being separated from it by a navigable strait; the other is more to the westward, being in W. Long. 168. 30. and N. Lat. 54. 30. The circumference of Oonella is about seven leagues, and the produce of both much the same with that of Oonalashka.

OPACITY, in *Philosophy*, a quality of bodies which renders them impervious to the rays of light.

OPAH, commonly called the *king fish*. See ZEUS, ICHTHYOLOGY *Index*.

OPAL, in *Natural History*, a species of gems. See MINERALOGY, p. 169.

OPALIA, in *Antiquity*, feasts celebrated at Rome in honour of the goddess Ops. Varro says they were held on the 19th of December, which was one of the days of the Saturnalia: these two feasts were celebrated in the same month, because Saturn and Ops were husband and wife: the vows offered to the goddess were made sitting on the ground.

OPARO, or OPARRO, a small island in S. Lat. 27° 36′, and in E. Long. 215° 49′, which was discovered by Vancouver. This island was supposed to be about six miles and a half long, and it was out of sight of any other land. It is composed of craggy mountains, forming in several places perpendicular cliffs from their summits to the sea, having narrow valleys or chasms interposed. On some of the highest hills were observed some kind of works, resembling fortified places; but as the discoverers did not land on the island, they could not learn their nature and use. In their language and appearance the natives resembled those of the Friendly islands; they seemed acquainted with the use of iron, preferring it to beads and other trinkets, and showed a hospitable disposition. There appeared to be anchoring ground near the north-west end of the island.

OPERA, a dramatic composition set to music, and sung on the stage, accompanied with musical instruments, and enriched with magnificent dresses, machines and other decorations.—This species of drama is of modern invention. In its present state it was not known even in Italy before the beginning of the last century; and at its introduction into England, a century afterwards, it divided the wits, literati, and musicians of the age. By those who were esteemed the best judges of the art, the English language was considered as too rough and inharmonious for the music of the opera; and, on the other hand, critics, whose taste was built on the basis of common sense, looked upon a drama in a foreign and unknown tongue as the greatest of all absurdities. Many of them, however, pleaded for operas in the English language; and it is well known that Addison, who was one of the opposers of the Italian opera on the London stage, wrote in his native tongue the opera of Rosamond. This is confessedly a beautiful poem; but, in the opinion of Dr Burney, it adds nothing to Addison's fame, as it shows his total ignorance of the first principles of music, and of course his unfitness for the task he had undertaken.

In questions respecting the fine arts there is no appeal from the general taste; and therefore, as the French opera, which is in the language of the country where it is acted, has always been admired by persons of liberal education, it doubtless has merit considered as a drama; but how the dramas of this kind which are composed in Italian should find admirers in England among persons who understand not a word of the language, it is to us a matter of astonishment. The music of them may deserve and command the admiration of every one who has

has an ear; and the action of the singers may be perfectly suitable to the subject represented; but of this suitableness the majority of the audience can be no judges.

Even when the language is thoroughly understood, we should imagine, that, to make an opera agreeable to good sense, much would depend upon the choice of the subject; for it is surely absurd to have persons of all ranks, and on every occasion, perpetually accompanied with the regular responses of symphony. To hear Cæsar, Scipio, or Macbeth, when forming plans to ensure victory, or hatching plots of treason and murder, talking in recitative and keeping time with fiddles, would surely disgust every person whose sense had not all evaporated in sound; but when the subject represented naturally admits of music in real life, we can suppose an opera to afford to persons of taste one of the most exquisite and refined entertainments of which human nature is capable. For a further account of the opera, see MUSIC, page 497, and POETRY, N° 133, &c.

OPERATION, in general, the act of exerting or exercising some power or faculty, upon which an effect follows.

OPERATION, in *Surgery* and *Medicine*, denotes a methodical action of the hand on the human body, in order to re-establish health.

OPHIDIUM, a genus of fishes belonging to the order of apodes. See ICHTHYOLOGY *Index*.

OPHIOGLOSSUM, ADDER'S TONGUE, a genus of plants, belonging to the cryptogamia class, and to the order *Filices*. See BOTANY *Index*.

OPHIOLOGY.

INTRODUCTION.

1 Definition. THE term *ophiology* is composed of two Greek words, namely οφις, a *serpent*, and λογος, a *discourse*, and consequently denotes that branch of zoology which treats of serpents. The latter constitute an order in the class of amphibious animals. They are covered with scales, breathe by means of lungs, and are destitute of feet and fins.

2 Historical notices of ophiological writers. The hideous aspect of some of the species, and the poisonous properties of others, long contributed to prevent any deliberate investigation of their structure, constitution, and modes of existence. 3 Ancient. Hence the ancients, who at best had very imperfect notions of classification, sometimes indicate different species under the same name, or bestow different appellations on the same species, and moreover blend their vague descriptions with the embellishments or absurdities of fable.

4 Modern. Among the moderns, few naturalists have directed their researches to the history of serpents. "It must be acknowledged," observes Dr Russel, "that it offers no attractive allurements; and that those who, from other avocations, can only spare transient attention to subjects of natural history, are more likely to prefer objects less disgusting, and experiments accompanied with less cruelty and personal danger. Even the eager and resolute naturalist has to contend with many difficulties in this path of research. He cannot at once divest himself of the abhorrence, next to innate, of these reptiles; nor can he soon acquire a dexterity in handling them, with that calmness requisite for his own safety. The search for plants, for birds, or even insects, is comparatively pastime, or pleasurable occupation; but in the actual pursuit of the disgusting race of serpents, he stands in need of assistants, who are not at all times to be procured; and if he rely solely on the diligence of such as he may employ, he will find himself exposed to the chagrin of incessant disappointment."

5 Seba. Seba has indeed presented us with a numerous catalogue; but his species are too multiplied, and his descriptions too concise. 6 Catesby. Catesby was more solicitous to design and colour his serpents, than to unfold their discriminating characters. 7 Gronovius. The descriptions of Gronovius are for the most part well and accurately detailed; but they are unprovided with the specific names.

8 Linnæus. Linnæus, availing himself of the works to which we have just alluded, of the discoveries of Garden, and of his own discernment, published his method of distinguishing the species by the number of scaly plates on the abdomen, and beneath the tail. Experience has indeed proved, that these do not always constitute an infallible criterion, and that more obvious marks, such as the relative size of the head, the length of the body and tail, &c. must sometimes be resorted to: it must, however, be allowed, that the celebrated Swedish naturalist paved the way to a far more accurate nomenclature of serpents than had yet appeared, and that the value of his scientific distinctions is greatly enhanced by the interesting notices on the same subject, which are inserted in his *Amœnitates Academicæ*, and in the first and second volumes of his *Adolphian Museum*.

9 La Cépède. The count de la Cépède has in some respects improved the Linnæan arrangement, and exhibited a more complete catalogue than any of his predecessors. 10 Shaw. Dr Shaw has likewise displayed his usual sagacity in the second part of the third volume of his General Zoology, which is allotted to his exposition of the serpent tribes. 11 Owen, Klein, &c. To these we may add, Owen on the natural history of serpents, Klein's Tentamen Herpetologiæ, Blumenbach's Beyträg zur Naturgeschichte der Schlangen, Schneider's Allgemeine Betrochtungen uber die Eintheilung und Kennzeichen der Schlangen, Merian's Beytrage zur geschichte der Amphibien, Laurenti's Specimen Medicum, continens Synopsin Reptilium, Bonaterre's Ophiologie, in the Encyclopédie Méthodique, Latreille's Histoire Naturelle des Reptiles, Russel's Account of Indian Serpents, &c. &c.

Anatomy and Physiology of Serpents.

12 Body. THE body of serpents is very long when compared with its thickness; and is sometimes quite cylindrical, or rounded, sometimes compressed on the sides, sometimes flat on the under surface, and sometimes attenuated towards the tail. It is usually covered with scales; but sometimes naked, either rough, or slippery to the touch,

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and banded, spotted, or reticulated; the skin exhibiting great varieties in the tints and distribution of the colours.

13 Head. The head is either distinct from the trunk, or confounded with it, and is convex, or flattened, oval, triangular, or heart-shaped, and furnished with plates, or imbricated scales. It includes the mouth, snout, jaws, lips, teeth, tongue, eyes, and nostrils. There is no visible external ear; though animals of this order doubtless possess the faculty of hearing.

14 Mouth. The mouth is that cavity which is situated between the jaws. It is very large in proportion to the size of the head, and is capable of being widely extended.
15 Snout. The snout is the anterior part of the head: it is slanting,
16 Jaws. elongated, obtuse, truncated, or reflexed. The jaws, which are either of equal or unequal length, are composed of two bones, which do not, as ours, open in the manner of a pair of hinges, but are held together at the roots, by a stretching muscular skin, so as to open as widely as the animal chooses to stretch them. By this contrivance serpents are enabled to swallow animals
17 Lips. thicker than themselves. The lips are entire, notched,
18 Teeth. or reflexed. The teeth, in the jaws, are generally sharp-pointed, and, in serpents not poisonous, are disposed in three rows in the upper jaw, one row exterior and two interior. The under jaw is sometimes provided with a
19 Fangs. single row. The noxious species are furnished with canine teeth, or fangs, of a tubular structure, situated in the projecting part of the upper jaw, commonly of a much larger size than the other teeth, and frequently accompanied by smaller or subsidiary fangs, apparently destined to supply the principal ones, when lost either by age or accident. The fangs are situated in a peculiar bone, so articulated with the rest of the jaw, as to elevate or depress them at the pleasure of the animal. In a quiescent state they are recumbent, with their points directed inwards or backwards; but, in the moment of irritation, their position is altered by the mechanism of the above-mentioned bone, in which they are rooted,
20 Tongue. and they become almost perpendicular. The tongue is usually straight and slender, composed of two long and rounded fleshy substances, which terminate in sharp points, and are very pliable. They unite at about two thirds length, and the root is connected to the neck by two tendons, which give the whole organ a great variety and facility of motion. In most species, the tongue is almost wholly inclosed in a sheath, or integument, from which the animal can dart it out of its mouth, without opening its jaws; the upper mandible having a small notch, through which it can pass. Some of the viper kinds have tongues a fifth part of the length of their bodies, and, as they are constantly darting them out, terrify those who are ignorant of the real situation of
21 Eyes. the poison. The eyes are small, when compared with the length of the body, and greatly vary in respect of liveliness and colour. In some species the upper eyelid is wanting, while others have a nictitating membrane, or skin, which keeps the organ clean, and preserves the sight. In all, the substance of the eye is hard and horny, the crystalline humour occupying a great part of the globe. The pupil is susceptible of considerable contraction and dilatation, and the iris is often of a
22 Nostrils. golden or fine red colour. The nostrils are two openings at the extremity of the snout, for receiving the sensation of smell.

The trunk is that part of the body which reaches from the nape to the vent. It is scaly, annulated, tuberculated, or wrinkled; and comprehends the back, sides, belly, anus, organs of generation, and scales. The 23 Trunk.
back is the upper part of the trunk, commencing at the 24 Back.
nape and terminating immediately above the vent. In most species it is rounded, but in some carinated or fur- 25
rowed. The sides are the lateral portions of the trunk, Sides.
from the extremity of the jaws to the vent. The belly, 26 Belly.
or abdomen, is the lower part of the body, from the head to the tail, the want of a diaphragm precluding a breast. The anus is an opening, usually transverse, 27 Anus.
placed at the extremity of the lower surface of the trunk, forming the line of demarcation between the latter and the tail, and affording a passage to the liquid and solid excrements. The penis of the male, and the ovary of the female, are also situated in this common vent, from which they are extended only during the 28
season of pairing. The scales, properly so called, are Scales.
round, oval, oblong, and attenuated at the extremities, rhomboidal, smooth, or carinated. The broad undivided plates on the belly and head, are termed *scuta*, and the smaller or divided plates beneath the tail, are called *squamæ subcaudales* or *scutella*, *subcaudal scales* or *platelets*.

29 Tail. The tail is attenuated, obtuse, square, in the form of a triangular pyramid, flattened or compressed at the sides.

30 Skeleton. As serpents have neither limbs nor breast, the structure of their skeleton is much less complex than that of quadrupeds. The bones of the head are from eight to ten. The skull, which is sometimes flat and sometimes convex, is very hard and compact, and exhibits four principal sutures, which are with difficulty separated. The bones of the trunk consist of a series of vertebræ, incased in one another, and articulated with the ribs. The caudal vertebræ are disposed in the same manner, and provided with similar processes; but they are unconnected with ribs, and gradually diminish in size as they approach to the end of the tail. In most quadrupeds, the joints in the back-bone seldom exceed thirty or forty; whereas in serpents they often amount to 145, from the head to the vent, and 25 more from that to the tail. The number of these joints must give the back-bone a surprising degree of pliancy, which is still increased by the manner in which one is locked into the other. In man and quadrupeds, the flat surfaces of the bones are laid one against the other, and bound tight by sinews; but in serpents the bones play one within the other, like ball and socket, so that they have free motion in every direction.

31 Muscles. The remarkable strength and agility, manifested by serpents, depend on the vigorous muscles with which they are provided. Several of these are inserted along and beneath the skull, and about the upper and lower jaws. Four, which are denominated *lateral*, have their origin behind the head, and descend, by each side, to the extremity of the tail. Each vertebra has also its corresponding intercostal muscle, which serves the same purposes as in other animals.

32 Viscera. The internal organs, or viscera of individuals of this order of animals, nearly correspond to those of others, and, consequently, need not long detain us.

33 Brain. The brain is divided into five small portions, which are round, and somewhat elongated. The two first are placed

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placed between the eyes, and give origin to the olfactory nerves; other two are situated in the middle region of the skull; and the last, which is a little farther back, appears to be the commencement of the spinal marrow.

34 Tracheal artery. The tracheal artery, composed of distinct and cartilaginous rings, has its origin at the top of the gullet, and communicates with the lungs, under the heart.

35 Lungs. The lungs are not lobed, but consist of a cellular and membranous substance, abundantly furnished with blood vessels.

36 Oesophagus. The œsophagus is formed of a single membrane, extends to the orifice of the stomach, is of an equal diameter throughout, and susceptible of an extraordinary degree of dilatation.

37 Stomach. The stomach, which is of a larger capacity, is formed of two concentric tunics, which closely adhere, and which are internally covered with folds or wrinkles.

38 Heart. The heart has two ventricles, and is small in proportion to the size of the body. As the circulation of the blood is independent of the lungs, the animal is enabled to remain for a considerable time under water. It cannot, however, make this element its constant residence; because occasional supplies of fresh air are necessary to preserve in its blood those qualities which are necessary to motion and vitality. In serpents, therefore, as well as in viviparous quadrupeds, respiration is essential to life. This function they do not perform by a rapid succession of alternate dilatations and contractions of the lungs; but, having this viscus remarkably large in proportion to their bodies, they are able to fill it with a considerable provision of air; and as they expire very slowly, some time will elapse before they are obliged to inspire again.

39 Intestinal canal. The intestinal canal is narrow, sinuous, and internally divided by many transverse partitions.

40 Kidneys. The kidneys are particularly large, and composed of small continuous glands, blended with excretory vessels.

41 External senses. That animals of the serpent-kind possess the use of the five external senses, can scarcely admit of dispute. We have indeed, remarked, that most of the species appear to want an external auditory passage; but it is certain that they are often directed to birds, by listening to their notes; and many indicate a degree of sensibility to the sounds of musical instruments. Their sense of smell, with a few remarkable exceptions, is neither very active nor acute; but, in most, that of sight is quick and penetrating. The soft and nervous texture of the tongue and palate would induce a suspicion, that they enjoy the sense of taste in a pre-eminent degree; yet, as they generally swallow their food in large portions, they seldom avail themselves of the delicacy of these organs. Being unprovided with feet, hands, or feelers, their sense of touch is probably very imperfect; and even when they twine very closely round an object, the interposition of their scales will render their feeling of its surface vague and obtuse.

42 Sexual union. The sexual union of serpents usually takes place in the sunny days of spring, is very close and ardent, and varies in duration from an hour to several days, according to the species, but terminates without any permanent attachment.

43 Oviparous. The females of some are oviparous, and of others viviparous. The eggs of the former vary in respect of size, colour, and number, according to the species and constitution of the individual; and they are deposited, not in continuous succession, but at intervals, and sometimes with the appearance of much suffering on the part of the female. Sergerus relates, that he saw a female snake, after twisting herself, and rolling on the ground in an unusual manner, bring forth an egg. He immediately took her up, and facilitated the extrusion of thirteen more, the laying of all which consumed an hour and a half; for, after depositing each, she rested for some time. When he remitted his assistance, the process was more slow and difficult; and the poor animal seemed to receive his good offices with gratitude, which she expressed by gently rubbing her head against his hands. The mother never hatches these eggs, but leaves them exposed in some warm situation, as in holes with a southern aspect, on dry sand, under moss or foliage, on a dunghill, near an oven, &c. The outer covering of the egg is a thin compact membrane, and the young serpent is spirally rolled in its albuminous liquid.

Physiology of Serpents.

The viviparous species differ considerably, both with respect to their periods of gestation, and the number of their offspring. 44 Viviparous. Thus, vipers which go about three months with young, generally breed twice a-year, and produce from twenty to twenty-four, while the blind-worm, which is pregnant about a month, brings forth sometimes seven, and sometimes ten at a birth. When young serpents are hatched or produced, they are abandoned to the resources of their own instinct, and often perish before they have acquired sufficient experience to shun the snares which are laid for them by quadrupeds, birds, and reptiles.

In regard to the different stages of growth of the different species, little precise information seems to have been obtained: and, though some arrive at a very large size, their dimensions have, no doubt, been much exaggerated. 45 Growth.

The young of the viper, at the moment of parturition, measures from twelve to fifteen lines; and two or three years elapse before they are capable of reproducing their kind. 46 Size. Adanson however concludes, from ocular observation, that the largest serpent in Senegal may measure from forty to fifty feet in length, and from a foot to a foot and a half in breadth. Leguat assures us, that he saw one in Java, that was fifty feet long. Carli asserts, that they grow to upwards of forty feet. Mr Wentworth, a gentleman who had large concerns in the Berbices, informs us, that he one day sent out a soldier, with an Indian, to kill wild fowl for the table; and they accordingly went some miles from the fort. In pursuing their game, the Indian, who generally marched before, beginning to tire, went to rest himself on the fallen trunk of a tree, as he supposed it to be; but, when he was just going to sit down, the huge monster began to move, and the poor savage, perceiving that he had approached a Boa, dropped down in an agony. The soldier perceiving what had happened, levelled at the serpent's head, and by a lucky aim shot it dead. He continued his fire, however, until he was assured that the animal was killed; and then going up to rescue his companion, he found him killed by the fright. The animal was brought to the fort, and was found to measure thirty-six feet. Mr W. caused the skin to be stuffed, and sent it as a present to the Prince of Orange. We are told, that when Regulus led his army along the banks of the Bagrada, in Africa, an enormous serpent disputed his passage across the river. If we can give credit to Pliny, this reptile was 120 feet long, and had destroyed many of the soldiers, when it was overcome in turn by the battering engines. Its spoils were carried

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to Rome, and the general was decreed an ovation for his success. The skin was preserved for years after in the capitol, where Pliny says that he saw it.

47 **Voice.** In regard to voice, some serpents are apparently silent, and others have a peculiar cry; but hissing is the sound which they most commonly utter, either as a call to their kind, or a threat to their enemies. In countries where they abound, they are generally silent in the middle of the day; but, in the cool of the evening, they issue from their retreats with continued hissings.

48 **Masses of food.** The masses of food which serpents are enabled to swallow, would appear quite miraculous, did we not reflect on the lax structure of their jaws, their power of crushing their victims, and the viscid humour, or saliva, which lubricates the crude morsel in its passage down an extensile œsophagus. In spite of all these circumstances, the quantity of aliment is sometimes so voluminous, that it sticks in the gullet, when only partly immersed in the stomach, and the animal lies stretched and nearly motionless, in its retreat, till the swallowed portion be digested, and the extruded half introduced, to undergo the same process.

49 **Capability of abstinence.** But, though serpents thus occasionally gorge themselves with food, as their blood is colder than that of most other terrestrial animals, and circulates slowly, their powers of digestion are feeble and tardy, so that they can endure weeks, and even months of abstinence. Nay, so tenacious are they of the vital principle, that they exist and grow in mephitic marshes, continue to breathe, for a considerable time, in the exhausted receiver of an air-pump, and frequently exhibit symptoms of life after one part of the body has been severed from the other. Vipers are often kept in boxes, for six or eight months, without any food whatever; and there are little serpents sometimes sent to Europe from Cairo, which live for several years in glasses, and never eat at all.

50 **Age.** The natural term of the existence of serpents, is not accurately known; but it has been conjectured, that some of the larger kinds may complete a century. The first failure of their strength is the almost immediate forerunner of their dissolution; for, when deprived of the requisite elasticity of frame to spring on their prey, and of the requisite force to combat their enemies, they shrink into their recesses, and die of hunger, or are easily devoured by the ichneumon, stork, and other powerful assailants.

51 **Hybernation.** In the more northerly and temperate regions of the globe, the serpent tribes, towards the end of autumn, fall into a state of torpor, more or less profound, according to the greater or less intensity of the cold; and in this condition they remain, nearly lifeless, till the approach of spring reanimates their stiffened frame.

52 **Renewal of skin.** Soon after its resuscitation, the serpent works itself out of its old epidermis, by rubbing itself against the ground, or by wedging itself between any two substances that are sufficiently close to each other. The exuviæ come off entire, being loosened first about the head; and are always found turned inside out. It is some time before the scales acquire a sufficient degree of hardness to defend the animal against external injury; and, during this interval, it generally confines itself to its retreat.

Generic and Specific Exposition of the Order.

Gen. I. Crotalus. *Rattle-Snake.* 53 **Crotalus.**

54 **Generic characters.** Scuta on the abdomen, scutæ and squamæ beneath the tail, rattle terminating the tail.

The animals of this genus inhabit America, where they prey on the smaller birds, lizards, and insects. They are furnished with poisonous fangs, and have a broad head, covered with large scales. Their snout is obtusely rounded.

55 **Horridus.** *Banded Rattle-Snake, Common Rattle-Snake,* or *Boiquira.*—The characters are, 167 abdominal, and 23 subcaudal scuta. The ordinary length of this species is from three to four or five feet, and the greatest thickness that of a man's arm. The prevailing colour is a yellowish brown, marked with cross and irregular bands of a deeper shade, and two or three longitudinal stripes from the head down the neck; the under parts are of a dingy brown, with many dusky variegations and freckles. The mouth is capable of great distension. The tongue is black, slender, bipartite, and inclosed in a kind of sheath, from which the snake darts forth the double point, and vibrates it with great velocity. The rattlesnake is viviparous, producing in June about twelve young, which, by September, acquire the length of about twelve inches. These, it is said to preserve from danger, like the viper in Europe, by receiving them into its mouth, and swallowing them. In confirmation of this assertion, we shall quote the words of M. de Beauvois, who, during his residence in America, bestowed particular attention on the history of amphibious reptiles.

"Among the information which I endeavoured to obtain in my travels with respect to serpents in general, there was one point which greatly excited my curiosity. Several persons, and one among the rest to whom I owe a debt of gratitude for civilities and marks of friendship, which will for ever rest engraven on my heart, had informed me, that the female rattle-snake concealed its young ones in its body; that when they were alarmed by any noise, or by the approach of man, they took refuge in the body of their mother, into which they entered by her mouth. This fact had been already ascertained with respect to the viper of Europe; but in consequence of the unfavourable and repulsive dispositions inspired by this kind of reptile, and in order to render it still more hideous, an absurd interpretation was given to this fact. It was pretended, that this serpent eats its little ones after having given them birth. Curious to verify this fact related of the boiquira, I was constantly occupied with this idea, and began to despair of ever making the observation, when, at a moment in which I thought the least of it, accident furnished me the means. Having fallen sick among the Indians, I found myself obliged to remain a few days with one of them in the neighbourhood of Pine-log. During my convalescence, I took a walk every morning in the neighbourhood, and one day when I was following a pretty broad path, I perceived, at a distance, a serpent lying across the road in the sun. I had a stick in my hand, and drew near to kill it; but what was my surprise, when, in the moment that I was about to give the blow, the

Crotalus. the reptile perceived me, coiled up itself, and opened its large mouth, into which five serpents, which I had not till then observed, because they were lying along its body, rushed into the gulf which I had conceived opened for myself. I retired to one side, and hid myself behind a tree. The reptile had crawled a few paces, but hearing no further noise, and not perceiving me, stretched itself out afresh. In a quarter of a hour the young ones came out again. Satisfied with this observation, I advanced anew towards the animal, with intention to kill it and examine the interior of its stomach: but it did not permit me to approach so near as it did the first time, the young ones entered with still greater precipitation into their retreat, and the boiquira fled into the grass. My satisfaction and astonishment were so great, that I did not think of following it."

The rattle consists of a number of pieces, inserted into each other, all alike in shape and size, hollow, and of a thin, elastic, brittle substance, similar to the exterior part of the scuta. Their form is nearly that of an inverted quadrilateral pyramid, with the corners rounded off. The first piece, or that nearest the body, may be considered as a kind of case, which contains the three last vertebræ of the tail, on which it appears to be moulded, and has three convex, circular elevations corresponding with them; the two last of these elevations are fitted into the two first of the next piece; so that of every piece except the last, the first only of the elevations is exposed to view, the two others being inclosed in those of the following, in which they have room to play from side to side. These several pieces have no muscles, nerves, nor ligaments, nor are they connected either with each other, or with the body of the serpent any otherwise than by the mode of insertion already described. Thus they derive no nourishment from the animal, and are merely an appendage which can have no other motion than what is communicated to it by that of the tail. These several pieces of which the rattle consists, appear to have been separately formed. Dr Van Meurs imagines them to be no other than the old epidermis of the tail, which, when its nourishment is intercepted by the new skin formed beneath it, grows hard and brittle. Hence, he supposes, that whenever this part acquires a new skin, a new piece of the rattle is added to the former, which is thus detached from the vertebræ, and shoved farther from the tail. The number of these pieces, however, affords no certain criterion of the animal's age, because those which are most remote from the tail, become so dry and brittle, that they are very liable to be broken off and lost.

The two principal fangs are placed without the jaws, on a separate bone, and the smaller ones attached to muscles and tendons. These fangs may be couched, or raised, at the pleasure of the animal, and are furnished with an opening near the root, and a slit towards the point, so that on pressing gently with the finger on the side of the gum, the poison, which is yellowish, is perceived to issue from the hollow of the tooth, through the slit. The vesicle which contains the poison, is externally of a triangular form, and of a tendinous texture; internally, it is cellular; and its interior part terminates in a small duct, communicating with the sacculus which covers the perforated teeth. It is furnished with a constrictor muscle, for the purpose of expressing its contents. The virulence of the latter may be inferred from various experiments reported in the Philosophical Transactions, and other publications. A rattle-snake of about four feet long, being fastened to a stake, bit three dogs, the first of which died in less than a quarter of a minute; the second, which was bitten a short time afterwards, in about two hours, and the third, which was bitten about half an hour afterwards, showed the visible effects of the poison in three hours, and likewise died. Other experiments were instituted; and lastly, in order to try if the snake could poison itself, it was provoked to bite a part of its own body, and actually expired in less than twelve minutes. Our limits will not permit us to enumerate various other instances of the almost instantaneous effects of this poison, which is most to be dreaded in hot weather, and when the animal is much irritated. The rattle-snake, however, is rather afraid of man, and will not venture to attack him unless provoked. It moves slowly, for the most part with its head on the ground, but if alarmed, it throws its body into a circle, coiling itself with the head erect in the centre, and with its eyes flaming in a terrific manner. In cases of slight bites, the Indians usually suck the wound. They have likewise recourse to the juices of various herbs, and to the root of *polygala seneka*; but these applications produce little effect, without scarification and ligatures. According to Dr Barton, the rude and simple practice of the western settlers, is, first, to throw a tight ligature above the part into which the poison has been introduced, at least as often as the circumstances of the case admit of such an application. The wound is next scarified, and a mixture of salt and gunpowder, or either of these articles, separately, laid on the part. Over the whole is put a piece of the bark of *juglans alba*, or white walnut-tree, which acts as a blister. At the same time, a decoction or infusion of one or more stimulant vegetables, with large quantities of milk, are administered internally: the doctor is, nevertheless, of opinion, that the beneficial effects of this mode of treatment are chiefly to be ascribed to the external applications. If the fang has penetrated a vein or artery, or attacked the region of the throat, the bite commonly proves fatal, and the patient expires in dreadful agony. "Where a rattle-snake, (says Catesby), with full force, penetrates with his deadly fangs, and pricks a vein, or artery, inevitable death ensues; and that, as I have often seen, in less than two minutes." "The Indians, (he continues), know their destiny the minute they are bit; and, when they perceive it mortal, apply no remedy, concluding all efforts in vain." Dr Barton, however, inclines to think, that this assertion should be received with considerable limitation, and that the application of ligatures, &c. even in cases apparently the most desperate, should not be neglected. According to Clavigero, the most effectual method is thought to be, the holding of the wounded part some time in the earth. But if the poison be once received into the general mass of the blood, it is almost needless to have recourse to medicines. A considerable degree of nausea is usually the first alarming symptom; the pulse becomes full, strong, and greatly agitated; the whole body swells; the eyes are suffused with blood; a hemorrhage frequently proceeds from the eyes, nose, and ears; large quantities of blood are sometimes thrown out on the surface of the body, in the form of sweat; the teeth vacillate in their sockets; and the pains and groans of

Crotalus. of the unhappy sufferer too plainly indicate, that the moment of dissolution is near at hand.

The following remarkable case is related by Mr Hector St John. A farmer was one day mowing with his negroes, when he accidentally trod on a rattle-snake, which immediately turned on him, and bit his boot. At night, when he went to bed, he was attacked with sickness, his body swelled, and before a physician could be called in, he died. All his neighbours were surprised at his sudden death; but the body was interred without examination. A few days after one of the sons put on the father's boots, and, at night, when he pulled them off, he was seized with the same symptoms, and died on the following morning. The physician arrived, and, unable to divine the cause of so singular a disorder, seriously pronounced both the father and son to have been bewitched. At the sale of the effects a neighbour purchased the boots, and on putting them on, experienced the like dreadful symptoms with the father and son. A skilful physician, however, being sent for, who had heard of the foregoing accidents, suspected the cause, and by applying proper remedies, recovered the patient. The fatal boots were now carefully examined, and the two fangs of the snake were discovered to have been left in the leather, with the poison-bladders adhering to them. They had penetrated entirely through, and both the father and son had imperceptibly scratched themselves with their point in pulling off the boots.

We are informed by Dr Barton, that a gentleman of Philadelphia had a large rattle-snake brought to him alive, which he so managed by a string, that he could easily lead it into, or out of a close cage. On the first day, he suffered this snake to bite a chicken, which had been allured to the mouth of the cage by crumbs of bread. In a few hours, the bird mortified, and died. On the second day, another chicken was bitten in the same manner, and survived the injury much longer than the first. On the third day, the experiment was made on a third chicken, which swelled much, but, nevertheless, recovered. On the fourth day several chickens were suffered to be bitten, without receiving any injury. These simple experiments enable us to assign a reason, why persons who have actually been bitten by the rattle-snake, have sometimes experienced very inconsiderable, or no bad consequences from the wound; they shew in what manner many vegetables have acquired a reputation for curing the bites of serpents, without our being obliged to impeach the veracity of those from whom our information is derived; and lastly, they teach us the physiological fact, that the poison of this reptile is secreted very slowly.

It has been observed by M. Gauthier, that the poison stains linen with a green hue, which is deeper in proportion as the linen has been impregnated with lixivium.

The pretended fascinating power of the rattle-snake is now generally discredited; and Dr Barton, professor of natural history in the university of Pensylvania, reduces the whole to the fluttering of old birds in defence of their young, and too near an approach to the formidable enemy. In confirmation of this opinion, he observes, that he can trace no allusion to the alleged fascinating faculty, in the ancient writers of Greece and Rome; that he doubts if it is credited by the American Indians; that Linnæus was extremely credulous; that the enchanting power of the rattlesnake is questioned by some eminent European naturalists; that the breath of this reptile is not remarkably infectious or pestiferous; that it often fails in catching birds; that the latter, and squirrels, are not its principal food; and that it is even devoured by some of the larger kinds of birds.

Mr Peale, an intelligent and zealous naturalist, kept a rattle-snake alive for five years and a half. "Curious to inquire, (says M. Beauvois), how this animal seizes his prey, he (Mr Peale) has confined several birds in the same cage with him, and the hungry reptile has made many attempts to take hold of the bird. This experiment has been repeated many times, and every time with the same effect. I have seen, myself, one of these birds in the cage; but whether the reptile was not hungry, or was sensible of its want of power, it remained perfectly tranquil, while the bird was perfectly at ease. It gave no indication which could make it be believed that it was either enchanted or affrighted; and the air did not appear different, if we might judge from its behaviour from that which is found in an ordinary close cage. The bird remained two days in the same situation, without the least attention paid to it by the reptile, who, in the mean time, ate a dead one which was presented to him.

"Another living bird was put into the cage with the serpent: far from being alarmed, it amused itself with pecking in the bottom, and picking up a few grains which it found there: often changing place in its accustomed manner, and even resting itself on the back of the boiquira, which made no extraordinary movements. This experiment was made several times.

"Mr Peale, his children, and myself, have often examined the reptile. We never perceived it to send out the slightest suffocating odour. It is in vain to object, that the living birds thus given it were not of the kind fitted for its nourishment; for it has eaten the same birds, when presented to it dead, and it is not useless to remark, that it never refused one of them."

Catesby mentions an individual of this species, which was about eight feet long, and weighed from eight to nine pounds. It was seen gliding into a gentleman's house, and terrified all the domestic animals.

Mr St John, whom we have quoted above, once saw a tamed rattle-snake, as gentle as it is possible to conceive a reptile to be. It went to the water, and swam wherever it pleased, and when the boys to whom it belonged called it back, their summons was readily obeyed. They often stroked it with a soft brush: and this friction seemed to cause the most pleasing sensations; for it would turn on its back to enjoy it, as a cat does before the fire. We need scarcely add, that it had been deprived of its fangs.

Rattle-snakes abound in America, from Brazil to near Lake Champlain: but they are gradually disappearing in the more populous districts. According to Pennant, they affect woods and lofty hills, especially where the strata are rocky or chalky, as at the pass near Niagara. They particularly frequent the sides of rills, to prey on such small animals as resort thither to quench their thirst. In summer, they are generally found in pairs; in winter, they collect in multitudes, and retire under ground, beyond the reach of frost. Tempted by the warmth of a spring-day, they often creep out, weak and languid. A person has seen a piece of ground covered with them, and killed with a rod between sixty and

Crotalus. and seventy, till, overpowered with the stench, he was obliged to retire. They are most easily dispatched by a blow with a stick on the spine.

The American Indians often regale on the rattle-snake. When they find it asleep, they put a small forked stick over its neck, which they keep immoveably fixed to the ground, giving the snake a piece of leather to bite; and this they pull back several times with great force, until they perceive that the poison fangs are torn out. They then cut off the head, skin the body, and cook it, as we do eels. The flesh is said to be white and excellent. Hogs also sometimes devour the rattle-snake; but horses, dogs, and most other animals, regard it with antipathy and horror.

56 Durissus. *Striped Rattle-snake*, or *White Rattle-snake*.—172 abdominal, and 21 subcaudal scuta. From a foot and a half, to four feet and a half long. Distinguished from the preceding by a pattern of pale yellow streaks, forming a series of large rhombs, or lozenges, down the back. Has often been confounded with the former, on account of the same general aspect, constitution, and habits.

57 Dryinas. *Wood Rattle-snake*.—165 abdominal, and 30 subcaudal scuta. Of a lighter tinge than the two preceding, and marked with yellowish variegations on the back.—This species has been hitherto very imperfectly described; and Seba erroneously quotes it as a native of Ceylon.

58 Miliaris. *Miliary* or *Small Rattle-snake*.—132 abdominal, and 32 subcaudal scuta. Gray, with a triple row of black spots, and a red spot between each of the dorsal ones. The smallest of the genus; its ordinary length being about eighteen inches. From this circumstance, and the faint sound of its rattle, it is more dangerous than the larger species. It is also alleged that its bite is more active. Its poison, according to Lebeau, is most successfully combated by the volatile alkali. It is confined to the temperate regions of North America, particularly to Carolina, Louisiana, and Florida.

59 Atricaudatus. *Black-tailed Rattle-snake*.—170 abdominal, and 26 subcaudal scuta. The head greenish-gray, with two brown and oblong spots on the hinder part. The body of a reddish gray, speckled with brown points, and crossed by 24 lengthened patches, or bands, brown, and irregular, and accompanied, on each side, by two spots of a brighter colour. The back is marked by a longitudinal, fawn-coloured stripe. Scales very numerous, rhomboidal, and carinated.—From three to four feet long; a very venomous species; discovered by Bosc, in Carolina, and described in Daudin's Natural History of Reptiles.

60 Boa.

Gen. 2. Boa.

61 Characters. Scuta on the abdomen, and under the tail; but no rattle.

The boa tribe of serpents is very numerous, and contains some species which are remarkable for their huge dimensions. Their head is covered, like that of the crotali; but their tail terminates in a point. Their immense size has rendered them the objects of terror rather than of observation to mankind; while the quantity of food requisite for their sustenance, has precluded their multiplication within a limited range of country. Hence a considerable degree of confusion attaches to their history; and a rational suspicion arises, that, with the progress of culture and population, some of the more formidable sorts have either been exterminated, or driven from the haunts of men. Some naturalists have asserted, that individuals belonging to this genus have been found in Spain, Italy, and the south of France; but they appear to have mistaken some of the larger sorts of coluber for the boa, which last is a native of Asia, Africa, and America.

62 Constrictor. *Great* or *Constrictor Boa*.—240 abdominal, and 60 subcaudal scuta. The more ordinary disposition of its colouring is yellowish gray with a large, chesnut-coloured, chain-like pattern down the back, and triangular spots on the sides. A considerable degree of variety, however, is occasioned by the circumstances of age, sex, and climate; and even the number of scuta is by no means constant. Nature has bestowed on this celebrated reptile, uncommon strength and beauty, but has wisely withholden from it the poisonous properties of some of the smaller species. It frequently attains to twenty, or even thirty feet in length. Except, however, when stimulated by the calls of hunger, it is a sluggish and harmless animal, affecting moist and shady situations, and, occasionally, devouring large animals, which it crushes in its contorted folds. In the German Ephemerides, we have an account of a combat between one of these huge serpents and a buffalo, by a person who assures us, that he was himself a spectator. The serpent had for some time, been waiting near the brink of a pool, in expectation of prey, when a buffalo was the first animal that appeared. Having darted on the affrighted beast, it instantly began to wrap him round in its voluminous twistings, and, at every twist, the bones of the buffalo were heard to crack almost as loud as the report of a gun. It was in vain that the quadruped struggled and bellowed; its enormous enemy twined it so closely, that at length all its bones were crushed to pieces, like those of a malefactor on the wheel, and the whole body reduced to one uniform mass. The serpent then untwined its folds, to swallow its prey at leisure. To prepare for this, and also to make it slip down more smoothly, it licked the whole body over, and smeared it with a mucilaginous matter. It then began to swallow it at the end that offered the least resistance; the throat dilating to such an extraordinary degree, as to admit a substance which was thrice its own thickness.

In the Bombay Courier, of August 31. 1799, it is stated, that as a Malay prow anchored for the night, close under the island of Celebes, one of the crew went on shore, in quest of betel nut in the woods, and on his return, lay down to sleep, as it is supposed, on the beach. In the course of the night, he was heard by his comrades, to scream out for assistance. They immediately went on shore; but an immense snake of this species had already crushed him to death. The attention of the monster being entirely occupied with his prey, the people went boldly up to it, cut off its head, and took both it and the body of the man on board their boat. The snake had seized the poor fellow by the right wrist, where the marks of the teeth were very distinct; and the mangled corpse bore evident signs of being crushed. The length of the snake was about thirty feet, its thickness equal to that of a moderately sized man; and, on extending its jaws, the gape was found

Boa. found wide enough to admit a body of the size of a man's head.

The female deposits a considerable number of eggs, which seldom exceed three inches in their greatest diameter, on the sand, or under leaves exposed to the sun's rays.

In some districts of Africa, the great boa is regarded as an object of veneration, and on the coast of Mozambique, is worshipped as a god.

In a very interesting notice of this species, communicated to us by John Corse Scott, Esq. mention is made of a live individual, which was discovered in a field, near the cattle, by some labourers, in the province of Tipperah in Bengal. This snake, which measured fifteen feet and three inches in length, and eighteen inches in circumference, was stunned by repeated blows, before it could be secured, and tied with cords to a long bamboo. It was pretty active after it was untied, and made frequent darts at any person coming near it. On presenting a long stick, it repeatedly seized and bit it with great fierceness. On dissection, the heart was found to be of the size of a sheep's, with the communication open between the two ventricles. The liver was small in proportion, being about the size of the human pancreas, and, like it, divided into several lobes. The œsophagus, from the mouth to the pylorus, measured nine feet three inches, and its width was sufficient to admit a man's head with ease. The head was small, in proportion to the size of the animal, the eyes were dark and heavy, and the nostrils large; but there was no perceptible organ of hearing. From the mechanism of the jaws, they were capable of being distended so as to admit a substance or animal much thicker than the snake itself. This mechanism, and the absence of grinders, obviously prove, that the food is swallowed entire, without mastication. In a gorged individual of this species, Mr S. found an entire guana, and in another, a fawn, of a year old; but the bones of these quadrupeds were unbroken.

63 *Scytale.* *Spotted Boa.*—250 abdominal, and 70 subcaudal scuta. Cinereous, with large, round, black spots on the back, and smaller ones, with white centres, on the sides, and oblong markings, interspersed with smaller variegations on the abdomen. Of a size scarcely inferior to the preceding, and of similar manners. It is a native of several parts of South America, and, like other snakes, occasionally eaten by the Indians.

64 *Cenchris.* *Ringed Boa.*—265 abdominal, and 57 subcaudal scuta. General cast ferruginous, with large dark rings on the back, and blackish kidney-shaped spots, with white centres on the sides. The *aboma* of several writers. Grows to a large size, and is a native of South America, where it is treated with divine honours.

65 *Canina.* *Canine* or *Green Boa.*—203 abdominal, and 77 subcaudal scuta. Green, with cross, waving, and white dorsal bands. It has its specific name from the form of its head, which resembles that of a dog. Though destitute of poison fangs, it inflicts a severe bite, when provoked. It measures from four to twelve feet in length, inhabits South America, and is celebrated for its beauty.

66 *Phrygia.* *Embroidered Boa.*—A remarkably elegant species, native of the East Indies, and omitted by Linnæus. White, with a cinereous tinge on the back, and the body marked with black lace-like variegations. Boa.

Garden Boa.—290 abdominal, and 123 subcaudal scuta. Yellowish gray, with brown variegations, resembling in form the parterres of an old-fashioned garden, the body somewhat compressed, and the sides marked with cuneiform spots. From two to three or four feet long, and native of South America. 67 *Hortulana.*

Fasciated Boa.—233 abdominal, and 36 subcaudal scuta. Yellow, with dusky blue transverse bands. The body somewhat triangular, upwards of five feet in length, and five inches in the thickest part. Native of India, and very poisonous. 68 *Fasciata.*

An individual of this species was sent to Dr Russel, in a very languid and extenuated state. Being set at liberty, it remained for some time without moving, but soon began to crawl slowly towards a dark corner. A chicken being presented, it seemed not to regard it, though the bird fluttered about it, and even rested a toe on its head. The chicken was then put on the snake's back, and clung so fast with its toes, that when attempted to be separated, the snake was dragged a little way, without offering to resent the insult. An hour after, the chicken was again presented; but the snake shewing no disposition to bite, its jaws were forced asunder, and the naked thigh of the chicken so placed, that the jaws closed on part of it. The chicken, when disengaged, shewed immediate symptoms of poison: it couched, purged once or twice, and was not able to stand. In the course of the first ten minutes, after several ineffectual efforts to rise, it rested its beak on the ground; and the head was seized with paralysis. After 15 minutes, it showed a frequent disposition to lie down; but remained couched some minutes longer. In 20 minutes it lay down on one side, and, convulsions supervening soon after, it expired within 26 minutes.

Viperine Boa.—209 abdominal, and 19 subcaudal scuta. Gray, with a black waving dorsal band, edged with white; the sides spotted with black. About a foot and a half in length, including the tail, which is only one inch and a half long. Native of India, where its bite is said to produce a slow wasting of the fingers and toes. As, however, it has no fangs, and produces no deleterious effects on brute animals: the truth of the report seems to be very questionable. 69 *Viperina.*

Lineated Boa.—209 abdominal, and 47 subcaudal scuta. Blackish line, with white dotted, transverse, arched lines, and whitish abdomen. Slender, native of India, and highly poisonous. 70 *Lineata.*

Annulated Boa.—About two feet in length, somewhat ferruginous, with black rounded spots, included in rings on the back, reniform ocellated spots on the sides, and waving dusky variegations on the abdomen. Native of South America, figured by Madame Merian, and preserved in the Hunterian Museum, at Glasgow. 71 *Annulata.*

The other species belonging to this genus are, *enydris*, *ophryas*, *regia*, *murina*, *horatta*, *hipnale*, *contortrix*, and *palpebrosa*.

Gen. 3. Coluber, *Snake* (properly so called). 72 Coluber.

Scuta, or undivided plates, under the abdomen; squamæ, or broad alternate scales, under the tail. The latter 73 Characters.

Coluber.

ter, although alternate, are reckoned by pairs; but, in many instances, the number is still undetermined, and it sometimes varies in the same species.

This tribe contains about 200 species, which greatly differ from one another in size and habit. The poisonous sorts, which constitute about one-fifth of the whole, are generally distinguished from the rest by their large, flattish, subcordate heads, and rather short bodies and tails; whereas most of the harmless species have small heads, with longer bodies and tails in proportion. Laurenti and Latreille have ranged the former under the genus *Vipera*, and the latter under that of *Coluber*: but Linnæus, Daubenton, La Cépède, &c. include both sorts under *Coluber*. This family of serpents is widely diffused over various quarters of the world.

74 *Berus.* *Common Viper.*—146 abdominal scuta, 39 subcaudal scales. Attains to the length of two, or even of three feet. The ground colour of the body is a dingy yellow, deeper in the female than in the male. The back is marked with rhomboidal, as the sides are with triangular, black spots. Its black belly, the greater thickness of the head, and the more abrupt termination of the tail, sufficiently distinguish it from the common snake, with which it has been often confounded.

The viper arrives at maturity in six or seven years, and produces 10 or 12 live young at the end of the second or third. Mr White of Selborne killed and cut up a pregnant female, and found in the abdomen 15 young ones, about the size of full grown earth-worms. No sooner were they freed from confinement, than they twisted and wriggled about, set themselves up, and gaped very wide when touched with a stick, exhibiting manifest tokens of menace and defiance, though as yet no fangs were visible, even with the help of glasses.—That the young, for some time after birth, retreat, when alarmed, into the mouth of the mother, seems to be a fact satisfactorily ascertained.

Vipers are capable of supporting long abstinence, feed on reptiles, worms, and young birds, and become torpid in winter. Their poison rarely proves fatal to man, and is most successively counteracted by olive oil, thoroughly rubbed on the wounded part. They are usually caught by wooden tongs, at the end of the tail, as, in that position, they cannot wind themselves up to injure their enemy. Their flesh was formerly in high esteem, as a remedy for various diseases, particularly as a restorative. Of late years, however, it has lost much of its ancient credit, and is rarely prescribed by modern practitioners.

The common viper inhabits Europe and Siberia, and is by no means uncommon in Great Britain, being the only poisonous animal in the island, frequenting dry and stony districts, and especially the chalky countries. It abounds in some of the Hebrides, and is called *adder* by the Scots.

This species is subject to several varieties, which we cannot stop to enumerate. The *prester*, or *black viper*, resembles the *berus*, in almost every particular but colour; though Linnæus, and other eminent naturalists, rank it as a distinct species.

75 *Cacodæmon.* *American Black Viper.*—About the length of the preceding, but much thicker, black, and remarkable for the largeness of its head, which it distends, with a horrid hiss, when irritated. Its bite is reckoned as dangerous as that of the rattlesnake. It is a native of Carolina, chiefly frequenting higher grounds.

Egyptian Viper.—118 abdominal scuta, and 22 subcaudal scales. Somewhat ferruginous, spotted with brown; whitish beneath, with a short mucronated tail. Rather smaller than the common species. Imported in considerable quantities to Venice, for the use of the apothecaries in the composition of theriaca, &c. Native of Egypt, and supposed by some to be the asp of Cleopatra; but it is very difficult to ascertain the true asp of the ancients.

Charasian Viper.—Rufous, with the snout acuminated above, and the body marked with short, subconfluent, dusky, and transverse streaks. Nearly allied to the common species, and described by Charas, a celebrated anatomist of serpents in his day, but who contended, in opposition to Redi, that the symptoms caused by the viperine bite, proceeded from what he termed the *enraged spirits* of the creature, and not from the supposed poisonous fluid.

Redi's Viper.—152 abdominal scuta, and 32 subcaudal scales. Of an iron brown colour with a quadruple transverse series of short, subconfluent, brown streaks on the back. In other respects nearly allied to the common viper, but said to be more poisonous. It occurs in Austria and Italy, and is the sort which Redi chiefly employed in his experiments relative to animal poison.

Asp.—155 abdominal scuta, and 37 subcaudal scales. Somewhat rufous, with roundish, alternate, dusky spots on the back, and subconfluent ones near the tail. About three feet long, the head rather large, and covered with small carinated scales. Native of France, particularly of the northern provinces of that country. It is very doubtful if this be the genuine *coluber aspis* (Lin.); and still more so if it be the *asp* of the ancients.

Greek Viper.—155 abdominal scuta, and 46 subcaudal scales. Gray, with a fourfold series of transverse spots, those on the middle yellowish, and those on the sides dusky. Nearly a cubit in length, very thick towards the middle, and the head large and depressed. Inhabits Greece and the Grecian islands. According to Forskäl, its bite proves fatal by inducing insuperable sleep.

Cerastes, or *Horned Viper.*—150 abdominal plates, and 25 subcaudal scales. Pale yellowish, or reddish brown, with a few round, distant, or oblong spots, of a deeper tinge, scattered along the upper parts of the body, and the belly of a pale leaden hue. The two curved processes, situated above the eyes, give the animal a more than ordinary appearance of malignity. Its length varies from about 15 inches to two feet. It is found in many parts of Africa, especially affecting dry places and sandy deserts, and inflicting a dangerous wound on those who happen to approach it.

Horn-nose Snake.—127 abdominal plates, 32 subcaudal scales. Olive brown, with blackish variegations, a row of pale dorsal spots, surrounded by black, and a waving pale band on the sides. This fierce and forbidding species, which has its denomination from two large and pointed processes on the tip of the nose, is supposed to inhabit the interior part of Africa.

Megæra, or *Spear-headed Snake.*—224 abdominal plates,

plates, and 68 subcaudal scales. Brown, with yellow variegations, flat cordate head, and a large orifice on each side, between the eyes and nostrils. Native of Martinico, whence it is frequently called *yellow Martinico snake*. Measures, when full grown, five or six feet, has very large fangs, and inflicts a dangerous wound.

84 *Naja*. *Spectacle Snake*, or *Cobra de Capello*.—193 abdominal plates, 60 subcaudal scales. "Its general length (says Dr Shaw), seems to be three or four feet, and the diameter of the body about an inch and a quarter: the head is rather small than large, and is covered on the fore part with large smooth scales; resembling, in this respect, the majority of innoxious serpents: the back part, sides, and neck, with smaller ovate scales; and the remainder of the animal, on the upper parts, with small, distinct, oval scales, not ill resembling the general form of a grain of rice. At a small distance beyond the head is a lateral swelling or dilatation of the skin, which is continued to the distance of about four inches downwards, where the outline gradually sinks, into the cylindric form of the rest of the body. This part is extensile at the pleasure of the animal; and, when viewed from above, while in its most extended state, is of a somewhat cordated form, or wider at the upper than at the lower part: it is marked above by a very large and conspicuous patch or spot, greatly resembling the figure of a pair of spectacles; the mark itself being white, with black edges, and the middle of each of the rounded parts black. This mark is more or less distinct in different individuals, and also varies occasionally in size and form, and in some is even altogether wanting. The usual colour of the animal is a pale ferruginous brown above, the under parts being of a bluish white, sometimes slightly tinged with pale brown or yellow: the tail, which is of a moderate length, tapers gradually, and terminates in a slender sharp-pointed extremity.

This formidable reptile has obtained its Portuguese title of *cobra de capello*, or *hooded snake*, from the appearance which it presents when viewed in front in an irritated state, or when prepared to bite; at which time it bends the head rather downwards, and seems hooded, as it were, in some degree, by the expanded skin of the neck. In India it is everywere exhibited publicly as a show, and is, of course, more universally known in that country than almost any other of the race of reptiles. It is carried about in a covered basket, and so managed by its proprietors as to assume, when exhibited, a kind of dancing motion; raising itself up on its lower part, and alternately moving its head and body from side to side for some minutes, to the sound of some musical instrument which is played during the time. The Indian jugglers, who thus exhibit the animal, first deprive it of its fangs, by which means they are secured from the danger of its bite."

The *cobra de capello* is one of the most formidable and dangerous of the serpent tribe, though it is devoured with impunity by the *viverra ichneumon*. Dr Russel describes ten varieties of this species, and enters into many curious details relative to the effects of its poison on dogs and other animals. He never knew it prove mortal to a dog in less than 27 minutes, nor to a chicken in less than half a minute. Hence its poison, fatal as it is, seems to be less speedy in its operation than that of the rattlesnake.

Russellian Snake.—168 abdominal plates, 59 subcaudal scales. Brownish yellow; spots on the back acutely ovate, blackish, and edged with white; those on the sides smaller. About four feet long; native of India, and very poisonous. A chicken bitten in the pinion, by an individual of this species, was instantly infected, seized with convulsions, and expired in 38 seconds. Immediately after the chicken, a stout dog was bitten in the thigh. Within less than five minutes he appeared stupified; the thigh was drawn up, and he frequently moved it, as if in pain. He remained, however, standing, and ate some bread that was offered to him. In about 10 minutes the thigh became paralytic; in 15 minutes he entirely lost the use of it, and lay down howling in a dismal manner, frequently licking the wound, and making, at intervals, ineffectual attempts to rise. In 19 minutes, after a short cessation, he again began to howl, moaned often, and breathed laboriously, till his jaws closed. The few succeeding minutes were passed, alternately, in agony and stupor; and, in 26 minutes after the bite, he expired. A second dog, of much smaller size, was next bitten, and expired in the space of six hours. A rabbit was next exposed to the bite, and died in less than an hour. After this, another chicken was bitten in the pinion, and expired in less than six minutes. These experiments were all made with the same snake, in the course of the same morning. 85 *Russellii*.

Crimson-sided Snake.—188 abdominal, and 7 anal plates, 45 subcaudal scales. Violet black, with the abdomen and sides of a beautiful crimson, the plates margined with black. A singular and elegant species, with the proportions nearly those of the common English snake; poisonous; and a native of New Holland. 86 *Porphyriacus*.

Hæmachate Snake.—132 abdominal plates, 43 subcaudal scales. Red, clouded with white above, yellowish white beneath. Two feet or more in length; tail extremely short, and tapering to a point. Native of India; elegant, and poisonous. 87 *Hæmachates*.

Water Viper.—Brown above, banded with black and yellow beneath. "This serpent (says Catesby) is called, in Carolina, the *water rattlesnake*; not that it hath a rattle, but it is a large snake, and coloured not much unlike the rattlesnake, and the bite said to be as mortal. This snake frequents the water, and is never seen at any great distance from it: the back and head are brown; the belly transversely marked with black and yellow alternately, as are the sides of the neck; the neck is small, the head large, and armed with the like destructive weapons as the rattlesnake. It is very nimble, and particularly dexterous in catching fish. In summer great numbers are seen lying on the branches of trees hanging over rivers, from which, at the approach of a boat, they drop down into the water, and often into the boat on the men's heads. They lie in this manner to surprise either birds or fish, after which last they plunge, and pursue them with great swiftness, and catch some of a large size, which they carry on shore, and swallow whole. One of these I surprised swimming ashore, with a large catfish in its mouth. The tail is small towards the end, and terminates in a blunt horny point, about half an inch in length, and which, though harmless, 88 *Aquaticus*.

Coluber. harmless, is considered as of dreadful efficacy by the credulous vulgar, who believe, that the animal is able, with this weapon, not only to kill men and other animals, but even to destroy a tree by wounding it with it; the tree withering, turning black, and dying."

89 *Elegantissimus.* *Superb Snake.*—White, the head variegated with black, and the body marked above by a quintuple series of ocellated red spots. About two feet long, and poisonous.

90 *Argus.* *Argus Snake.*—Chesnut brown, yellow beneath, and banded above, by transverse rows of ocellated red spots. Above five feet in length; native of Arabia and Brazil, and very poisonous.

91 *Javanicus.* *Java Snake.*—312 abdominal plates, 93 subcaudal scales. Gray, the head striped with blue, and the body crossed by blue stripes, with gold-coloured edges. Frequent in the rice fields of Java, where it grows to the length of nine feet; but, in the more elevated and wooded situations, it attains to a still greater size, and is capable of devouring some of the larger animals. Splendid and innoxious.

92 *Natrix.* *Common* or *Ringed Snake.*—170 abdominal plates, 60 subcaudal scales. Olive brown, with a black patch, accompanied by a yellow one, on each side of the neck, a row of narrow black spots down each side, and dusky abdomen.

This species is pretty generally diffused over Europe, and is not uncommon in our own island, affecting moist and warm woods, basking or sleeping in the sunshine, and becoming torpid in winter. The female deposits a chain of from 12 to 20 eggs, about the size of those of the blackbird, connected by bunches of a gluey matter in dunghills, or warm recesses, near stagnant waters. The young come forth in the following spring. The common snake reappears in March or April, when it casts its skin so completely, that the spoil exhibits even the exterior pellicle of the eye. To adopt the language of Mr White, in his Naturalist's Calendar, "It would be a most entertaining sight, could a person be an eye-witness to such a feat, and see the snake in the act of changing his garment. As the convexity of the eyes in the slough is now inward, that circumstance alone is a proof that the skin has been turned; not to mention that now, the present inside is much darker than the outer. If you look through the scales of the snake's eye from the concave side, viz. as the reptile used them, they lessen objects much. Thus it appears, that snakes crawl out of the mouth of their own sloughs, and quit the tail part last, just as eels are skinned by a cookmaid. While the scales of the eyes are growing loose, and a new skin is forming, the creature, in appearance, must be blind, and find itself in a very awkward and uneasy situation."

This species occasionally frequents the water, and preys chiefly on frogs, mice, small birds, insects, worms, &c. It is not only perfectly harmless, but even capable of being domesticated. Mr White mentions, that he knew a gentleman who had one in his house quite tame. Though usually as sweet as any other animal, yet, whenever a stranger, or a dog or cat entered, it would begin to hiss, and soon filled the room with an almost insupportable odour. Mr Revett Shepphard of Caius college, Cambridge, had a common snake in his rooms near three months. "He kept it (says Mr Bingley) in a box of bran; and, during all that time, he never could discover that it ate any thing, although he frequently put both eggs and frogs, the favourite food of this species, into the box. Whenever he was in the room he used to let the animal out of its prison; it would first crawl several times round the floor, apparently with a desire to escape; and when it found its attempts fruitless, it would climb up the tables and chairs, and not unfrequently even up the chair of its owner as he sat at his table. At length it became so familiar as to lie in a serpentine form on the upper bar of his chair; it would crawl through his fingers, if held at a little distance before its head, or lie at full length upon his table, while he was writing or reading, for an hour or more at a time. When first brought into the room, it used to hiss and dart out its forked tongue; but in no instance emitted any unpleasant vapour. It was, in all its actions, remarkably cleanly. Sometimes it was indulged with a run upon the grass, in the court of the college; and sometimes with a swim in a large bason of water, which it seemed to enjoy very much. When this gentleman left the university, he gave his bedmaker orders to turn it out into the fields, which, he believes, was done."

Black Snake.—186 abdominal plates, 92 subcaudal scales. Glossy black, with a very long slender body. Five or six feet long, and not venomous, though often confounded by the ignorant and the timid with the rattlesnake. Native of North America. Its speed and activity, according to Brickell, are astonishing. Sometimes it will climb trees in quest of the tree-frog, or, for other prey, glide at full length along the ground: on other occasions it presents itself half erect, and appears to great advantage. It is so fond of milk, that it has been seen eating it out of the same dish with children, though they often gave it blows with their spoons on the head when it was too greedy. It persecutes rats with wonderful agility, pursuing them even to the roofs of barns and outhouses, and is therefore a great favourite among the Americans. 93 *Constrictor.*

Fasciated or *Wampum Snake.*—Blue above, paler, and variegated with brighter blue beneath. Its colours resemble those of the strings of Indian money, called *wampum*, composed of shells cut into regular pieces, and strung with a mixture of blue and white. Native of Carolina and Virginia, sometimes growing to the length of five feet, and perfectly innocent. 94 *Fasciatus.*

Blue Green Snake.—217 abdominal plates, 122 subcaudal scales. Bright blue green, with a purple tinge on the back, and whitish abdomen. A very beautiful species, about three feet long, harmless, and a native of Surinam. 95 *Viridissimus.*

Coach-whip Snake.—Brown, with pale abdomen; very long and slender, inoffensive, and native of North America. It runs with extreme swiftness, in pursuit of flies, &c. and is very easily tamed. 96 *Flagellum.*

Ornamented Snake.—Habit long, and very slender; colour jet black, with white flower-shaped spots, and white abdomen. This very elegant species inhabits some of the West India islands, and, according to Seba, is also found in Java and Ceylon. 97 *Ornatus.*

Domicella Snake.—118 abdominal plates, 60 subcaudal scales. A very elegant and harmless species, of a slender habit, with many jet-black cross bands, and a blackish line on the abdomen. It is alleged that the Indian ladies sometimes carry it in their bosoms. 98 *Domicella.*

Boaform.

99 Boæformis. *Boæform Snake.*—252 abdominal plates, 62 subcaudal scales. Whitish, with brown variegations; white beneath, with very short scuta, the under part of the tail variegated with black and white. Native of India, and so strong, that it can numb the hand by wreathing round the arm. Its bite, however, is not poisonous.

100 Domesticus. *Domestic Snake.*—245 abdominal plates, 94 subcaudal scales. Gray, spotted with brown, and a double black spot between the eyes. Native of Barbary, where it is domesticated for the purpose of destroying the smaller noxious animals.

101 Fasciolatus. *Fasciolated Snake.*—192 abdominal plates, 62 subcaudal scales. Cinereous, with whitish cross bands, and glaucous abdomen. Native of India, and not poisonous, as vulgarly believed.

102 Lineatus. *Lineated Snake.*—169 abdominal plates, 84 subcaudal scales. This beautiful and inoffensive species, though subject to considerable variety of aspect, may be generally distinguished by its bluish-green ground, and three or five brown linear stripes, of which that in the middle is broadest. It inhabits several parts of India, and is from two to three feet long.

103 Elegans. *Elegant Snake.*—202 abdominal plates, 146 subcaudal scales. Yellowish gray, with three broad reticulated blackish bands, a broad fillet on the abdomen, and the head freckled with brown. Length about two feet; tail very long and narrow. Native of South America. Well figured by Seba.

104 Mycterizans. *Long-snouted Snake.*—192 abdominal plates, 167 subcaudal scales. Slender, with a sharp-pointed snout; colour grass green, with a yellow line on each side of the abdomen. About three feet and a half in length, and half an inch in diameter. Native of North America, where it is often seen on trees, running very quickly in pursuit of insects.

105 Ahætulla. *Iridescent Snake.*—163 abdominal plates, 150 subcaudal scales. Tinge blue green, and gilded, accompanied with iridescent hues, with pale abdomen, and black streak across the eyes. From three to four feet long. Native of India. One of the most beautiful of the serpent tribe, and perfectly innocent.

To exhibit even short definitions of the other species included in the genus *Coluber*, would extend this article to a disproportionate length. Of most of the omitted sorts, however, we may observe, that the history is either not particularly interesting, or too little known.

106 Hydrus.

Gen. 4 Hydrus, *Water-snake.*

107 Characters. Body slender in front, gradually thickening, scaled; tail compressed.—This is a genus of recent institution, comprising those species of serpents which naturally inhabit the water.

108 Colubrinus. *Colubrine Hydrus.*—Lead-coloured, with black surrounding bands. Ordinary length about two feet and a half. The fangs are very small in proportion to the size of the animal. It is the *coluber laticaudatus* (Lin.), and inhabits the American and Indian seas.

109 Fasciatus. *Fasciated Hydrus.*—Long and slender; black, longitudinally marked by yellowish white pointed bands; upwards of two feet in length, poisonous, and native of the Indian seas.

110 Spiralis. *Spiral Hydrus.*—Yellowish, with brown bands; body spirally twisted. A rare and elegant species, thus described by Dr Shaw.

"Its length is about two feet, and its habit slender; the body much compressed throughout; the back rising into a very sharp carina; the abdomen being also carinated, but having a flattened edge of scales somewhat wider than the rest, and measuring about the fifteenth of an inch in diameter; the head is small, and covered with large scales; the mouth wide; the scales on the whole animal moderately small, ovate, and slightly carinated; the ground colour is yellow, barred in a beautiful manner from head to tail with deep chesnut brown or blackish fasciæ, each widening on the abdomen, and thus forming a highly distinct and handsome pattern when viewed on each side, seeming to constitute so many large, round, yellow spots on a blackish ground: the back, at about the middle, is marked along its upper part with a row of rather large, round, blackish spots, situated between the fasciæ, and so placed as to be in some parts on one side, and in others on the opposite side of the dorsal carina, while some few are seated on the middle of the ridge itself: this variegation is continued to the tail, which is about an inch and three quarters long, black or deep brown, with a few yellow patches towards its beginning; it is remarkably broad for the size of the animal, and very thin on the edges, so as to be semitransparent on those parts. The most remarkable circumstance in this snake is the singular obliquity of its form, the body in different parts being alternately flatter on one side than the other, and the pattern completely expressed on the flattened side only; the other, or more convex side, being unmarked by the round spots, and lying as it were beneath, thus constituting several alternately spiral curves: this snake seems of an unusually stiff and elastic nature, and the carina on the back is so sharp as to surpass in this respect every other species of serpent. This specimen is in the British Museum; but its particular history seems to be unknown."

Black-backed Hydrus.—Head oblong, body black above, and yellowish beneath; tail spotted. *Anguis platma*, Lin. Native of the Indian seas, and common about the coasts of Otaheite, where it is used as an article of food. 111 Bicolor.

Great Hydrus.—Livid, with brown bands, and hexagonal scales abruptly carinated. Upwards of three feet long. Native of the Indian seas. Its habits little known. 112 Major.

The other *hydri* are, *caspius*, *gracilis*, *cœrulescens*, *curtus*, *atrocœruleus*, *cinereus*, *piscator*, and *palustris*.

Gen. 5. Langaya. 113 Langaya.

Abdominal plates, caudal rings, and terminal scales. 114 Characters.

There is only one species known, viz.

Snouted Langaya.—184 abdominal plates, 42 caudal rings; but these numbers are subject to vary. Length between two and three feet, and diameter about seven lines, in the thickest part of the body. Colour of the upper parts reddish, or violet, of the under parts pale or whitish. Teeth like those of the viper. Native of Madagascar, where it is much dreaded. 115 Nasuta.

Gen. 6. Acrochordus. 116 Acrochordus.

Body completely covered with warts. 117 Character.

Javan Acrochordus.—This reptile was discovered in 118 Javanicus.

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Acrochordus. a pepper field, in the island of Java, in 1784. It measured eight feet in length, and 10 inches in diameter, in the thickest part of the body. It was blackish above, whitish beneath, and marked by dusk spots on the sides. Five young ones, full formed, and each nine inches long, were found in the belly. The Chinese esteem it as a food.

The *dubius* and *fasciatus* are so nearly allied to the preceding, that they may be regarded only as varieties.

119 ANGUIS.

Gen. 7. ANGUIS, *Slow-worm.*

120 Characters. Furnished with abdominal and subcaudal scales. Conformation resembling that of some of the lizard tribes, the body being composed of a series of moveable rings, which are easily broken and easily reproduced. A very harmless, and rather sluggish genus.

121 *Fragilis.* *Common Slow-worm*, *Blind-worm*, or *Long Cripple.*—135 abdominal, and the same number of subcaudal scales. Black, yellowish ash, or rufous gray; belly black, sides streaked with black and white, tail long and obtuse, scales small, soft, and compact. The colouring is subject to considerable variety. Length, from 10 to 12 inches, or more. Common in Europe and Siberia, frequenting hollow ways, woods, paths, rubbish, &c. Viviparous, subject to hybernation, living on worms and insects, and perfectly innoxious. It is observed of this species, as well as of some others, that, if struck with any degree of violence, the body not only breaks abruptly on the struck part, but even sometimes, at different places, and that the fragments will live a long while afterwards. Though of very gentle dispositions, the blind worm, like many of the family of serpents, refuses to eat in captivity, unless it be tamed. M. Daudin mentions that he kept one two months and a half, during all which time it constantly refused nourishment of every kind.—It is preyed on by various birds, hedgehogs, snakes, frogs, and tods.

According to Dr Shaw, the *Blue-bellied Snake*, or *Aberdeen Slow-worm* (*A. Eryx* Lin.) is only a variety of the *Fragilis.* It occurs in Scotland and North America.

122 *Scytale.* *Painted Slow-worm.*—240 abdominal, and 13 subcaudal scales. Varies much in colour, but is generally orange, with black blotches; sometimes black and white, sometimes pale rose and black, paler beneath, and elegantly fasciated with bars of deep black. Native of South America, particularly of Cayenne and Surinam. In preserved specimens, the orange hue is very apt to fade into white.

123 *Corallinus.* *Coral Slow-worm.*—Ground colour pale red, with coral-red variegations. A very beautiful species, native of Brazil.

124 *Ventralis.* *Glass Slow-worm.*—127 abdominal, 222 subcaudal scales. Blackish green, speckled with yellow, with a very short yellow abdomen, a deep furrow on each side of the body, from the corners of the mouth to the vent, and a tail more than twice the length of the abdomen. Native of North America, and not uncommon in Carolina, where it is called the *Glass Snake.* 'A small blow of a stick,' says Catesby, 'causes the body to separate, not only at the place struck, but at two or three other places, the muscles being articulated quite through the vertebræ.'

Snouted Slow-worm.—218 abdominal, and 12 subcaudal scales. Greenish black above, yellow beneath, snout elongated, tail terminating in a horny tip. Length about a foot. Native of Surinam.

Jamaica Slow-worm, or *Silver Snake.*—Pale brown, with a silvery gloss on the scales; the body, which rarely exceeds sixteen inches in length, gradually thickening, and the tail abruptly subacuminate.

The other species are, *meleagris*, *ater*, *maculata*, *leucomelas*, *rufa*, *reticulata* and *clivioca.*

Gen. 8. AMPHISBÆNA.

Body nearly cylindrical, with annular divisions round the body and tail. The skin divided in a longitudinal direction, by straight lines, forming with the wings so many square or parallelogrammic scales. A harmless and oviparous genus, native of the warmer regions of the new world, and not of Ceylon, as Seba has erroneously asserted.

White Amphisbæna.—223 abdominal, and 16 caudal scaly rings. Pale white, verging on yellowish, and unspotted. Two feet or more in length, and of a considerable proportionate thickness. Is found in woods, in Surinam, &c. where it preys chiefly on insects and worms.

Fuliginous Amphisbæna.—200 abdominal, and 30 caudal, scaly rings. Differs from the preceding chiefly by its black and white variegations. Common in Cayenne, Surinam, and Brazil; but Linnæus, and other naturalists, misled by Seba, have falsely represented it as a native of Libya, the island of Lemnos, &c.

Gen. 9. CÆCILIA.

Body cylindrical, wrinkles on the sides of the body and tail.

Eel-shaped Cæcilia.—Anguilliform, with distant wrinkles, and a very small cirrhus beneath each nostril. The skin of the whole body, when closely inspected, is found to be covered with very minute granules. About 18 inches long, native of South America, and destitute of poison fangs.

White-sided Cæcilia.—340 wrinkles on the body, 10 on the tail. Brown, with very close wrinkles, and a whitish lateral line. Native of South America.

Slender Cæcilia.—Brown, shaped like an earth-worm, nearly 14 inches long, and one fifth of an inch in diameter. The upper jaw is longer than the lower, and the teeth are so small, as not to be distinctly visible.

We cannot close our descriptive catalogue of the serpent tribe, without remarking, that the subject still requires elucidation; that the Linnæan characters are not always to be strictly interpreted; and that several species appear to have been overlooked, merely because the number of their scales could not be ascertained.

Miscellaneous Observations.

The formidable aspect of some serpents, and the poisonous qualities of others, have probably inspired mankind, in every age, with sentiments of terror and awe. In the rude periods of society, fear is akin to devotion, and Bartram informs us, that the rattle-snake is worshipped by several of the savage tribes in North America. On the

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the Gold and Slave coasts, a stranger, on entering the cottages of the natives, is often surprised to see the roof swarming with serpents, that cling there without molesting, and unmolested by, the natives. But his surprise will increase as he advances farther southward, to the kingdom of Widah, when he finds that a serpent is the god of the country. This animal, which travellers describe as a huge overgrown creature, has its habitation, its temple, and its priests. These last impress the vulgar with an opinion of its virtues; and numbers are daily seen to offer, not only their goods, provisions, and prayers, but even their wives and daughters at the shrine of their hideous deity. The priests readily accept the proffered females, and after some days of *penance*, return them to their suppliants, much benefited by the serpent's supposed embraces.

137 Enchantment of serpents.

The ancients seem to have been aware, that certain species of serpents were attracted by musical sounds, and have celebrated the *Psylli* and *Marsi*,

Ad quorum cantus mites jacuêre cerastæ.

At this day, there are jugglers in India, who train snakes to move and gesticulate to the sound of the flute; and we have already mentioned, that they tame the *Cobra de Capello*, and exhibit it to the populace. When the snake-man first provokes the creature to attack him, he covers his hand with an earthen jar, which he uses as a shield, and thus hurts the animal's mouth, and knocks it backwards whenever it attempts to bite. He continues this exercise for an hour, or longer, taking care, however, not to fatigue the snake too much, nor to hurt it so as to deter it from returning to the attack. Thus, the animal is gradually taught to raise itself, on presenting a jar, a stick, or even the bare hand, the motions of which it follows with its head, without daring to bite, lest it should again wound its mouth. The juggler accompanies this exercise with singing, so that what is really a defensive war on the part of the serpent, has the appearance of a dance. To render this exhibition less dangerous, the fangs are sometimes removed; but more frequently the snake is deprived of its poison, by being daily irritated to bite on a piece of cloth, or any soft spongy subsance; nay, they have the address and courage to press its head, and thus provoke it, while biting, to make it seize the cloth with greater violence, and more effectually express its poison.

The Egyptian enchanters, however, appear to have recourse to more ingenious and mysterious artifices. "They take the most poisonous vipers," says Hasselquist, "with their bare hands, play with them, put them in their bosoms, and use a great many more tricks with them, as I have often seen. I have frequently seen them handle those that were three or four feet long, and of the most horrid sort. I inquired and examined if they had cut out the viper's poisonous teeth; but I have with my own eyes seen they do not. We may therefore conclude, that there are to this day Psylli in Egypt; but what art they use is not easily known. Some people are very superstitious, and the generality believe this to be done by some supernatural art which they obtain from invisible beings. I do not know whether their power is to be ascribed to good or evil; but I am persuaded that those who undertake it use many superstitions.

"The circumstances relating to the fascination of serpents in Egypt, related to me," he continues, "were principally, 1. That the art is only known to certain families, who propagate it to their offspring. 2. The person who knows how to fascinate serpents, never meddles with other poisonous animals, such as scorpions, lizards, &c. There are different persons who know how to fascinate these animals; and they again never meddle with serpents. 3. Those that fascinate serpents, eat them both raw and boiled, and even make broth of them, which they eat very commonly amongst them; but in particular, they eat such a dish when they go out to catch them. I have been told, that serpents fried or boiled are frequently eaten by the Arabians both in Egypt and Arabia, though they know not how to fascinate them, but catch them either alive or dead. 4. After they have eaten their soup, they procure a blessing from their scheik (priest or lawyer), who uses some superstitious ceremonies, and amongst others, spits on them several times with certain gestures. This manner of getting a blessing from the priest is pure superstition, and certainly cannot in the least help to fascinate serpents; but they believe, or at least persuade others, that the power of fascinating serpents depends upon this circumstance."

On this subject, the celebrated Mr Bruce, in his Travels to discover the Source of the Nile, is also minute and explicit. Among other passages, we shall be content to quote the following.

"I will not hesitate to aver, that I have seen at Cairo (and this may be seen daily without trouble or expence) a man who came from above the catacombs, where the pits of the mummy birds are kept, who has taken a cerastes with his naked hand from a number of others lying at the bottom of the tub, has put it upon his bare head, covered it with the common red cap he wears, then taken it out, put it in his breast, and tied it about his neck like a necklace; after which it has been applied to a hen, and bit it, which has died in a few minutes; and to complete the experiment, the man has taken it by the neck and beginning at his tail, has eaten it as one would do a carrot or a stock of celery, without any seeming repugnance."

"I can myself vouch, that all the black people in the kingdom of Sennaar, whether Funge or Nuba, are perfectly armed against the bite of either scorpion or viper. They take the cerastes in their hands at all times, put them in their bosoms, and throw them to one another as children do apples or balls, without having irritated them, by this usage, so much as to bite. The Arabs have not this secret naturally; but from their infancy they acquire an exemption from the mortal consequences, attending the bite of these animals, by chewing a certain root, and washing themselves (it is not anointing) with an infusion of certain plants in water."

The testimony of Savary is not less precise. At the feast of Sidi Ibrahim, he saw a troop of people, seemingly possessed, with naked arms and fierce looks, holding in their hands enormous serpents, which twined round their body, and endeavoured to escape. But these enchanters avoided the bite, by grasping the animals strongly by the neck, then tore them with their teeth, and ate them alive, while the blood streamed from their mouth.

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The circumstance of seizing them fast by the neck, accords with the concluding part of the ensuing relation of Denon.

"Having been always curious to observe the means by which some men command the opinions of others, I regretted that I was not at Rosetta, at the procession of the feast of Ibrahim, in which the convulsions of the Psylli form the most entertaining part, to the populace, of this religious ceremony. To make up for my loss, I addressed myself to the chief of the sect, who was keeper of the *Okel* or tavern of the Franks; I flattered him; and he promised to make me a spectator of the exaltation of one of the Psylli, as soon as he should have *inspired* him. From my curiosity he thought I was likely to become a proselyte, and he proposed to initiate me, which I accepted; but when I learned that in the ceremony of initiation, the grand master spits in the mouth of the neophyte, this circumstance cooled my ardour, and I found that I could not prevail on myself to submit to such a point of probation. I therefore gave my money to the chief, and the high priest promised to let me see one of the inspired.

"They had brought with them some serpents, which they let loose from a large leather sack in which they were kept, and by irritation made them erect their bodies, and hiss. I remarked that the light was the principal cause of their anger; for as soon as they were returned into the sack, their passion ceased, and they no longer endeavoured to bite. They had a particular quality, which was that when angry, the neck for six inches below the head was dilated to the size of one's hand. I soon saw, that I had no greater reason to dread the bite of these serpents than their masters had; for having well remarked that the Psylli, while they were threatening the animal with one hand, seized it on the back of the head with the other, I did the same with one of the serpents with equal success, though much to the indignation of these mysterious quacks."

We have likewise heard of people in Europe who allowed themselves to be bitten by vipers, with impunity, to the great astonishment of the spectators. They first made the animal eat of a prepared paste, which closed the apertures in the fangs, and thus precluded the discharge of the poison.

138 Serpentine poison.

Various and contradictory opinions, conjectures, and fictions, have been advanced relative to the nature, action, and cure of serpentine poison. Among the vulgar errors connected with this subject, we may reckon the *sting*, fixed in the serpent's tail, and the flowing of venom from the *black forked tongue*, and from the *teeth* in general.

Towards the end of the 17th century, Ferdinand II. Grand Duke of Tuscany, invited Steno, Redi, and some other eminent men of science, to his court, with a view to investigate the history of this important phenomenon in the animal economy. Redi, in particular, instituted a great variety of experiments, and arrived at some useful discoveries. When he either caused a living viper to bite a dog, or wounded the latter with the teeth of one newly dead, the event was the same. If the bite was repeated, its effect became weaker, and, at length was lost, the poison contained in the vesicle being exhausted. He observed, that when the teeth of serpents were extended to bite, they were moistened over with a certain liquor, and that when the vesicle at the base was pressed, a drop of poison flowed to the point of the fang. When the poison thus flowing from the vesicle was received in soft bread, or a sponge, an animal bitten by the serpent received no more harm from the wound than from the pinch of a needle, till after a few days, when the venom was secreted afresh; but when an animal was wounded with the point of a needle dipped in the poison, it was tormented with the same pains as if it had been bitten by the viper itself. Having preserved some of this poison in a glass, and totally evaporated the moisture in the sun, when the residuum was diluted with water, Redi found, to his great surprise, that it had the same effect as when recent. But the boldness of Jacob Sozzi, a viper charmer, excited the astonishment of the learned. As they happened in the prince's presence to talk of the certain death which would attend the swallowing of viperine poison, Sozzi, confiding in his art, drank a considerable portion of it without hesitation, and with the same safety as if he had drunk so much water. This result, which so much startled the grand duke and his philosophic associates, was not unknown to the ancients, as may be inferred from these lines in Lucan.

Noxia serpentum est admisto sanguine pestis:
Morsu virus habent et fatum dente minantur,
Pocula morte carent.

The ingenious and indefatigable Fontana made no fewer than 6000 experiments on this interesting subject. Of these, our limits will not permit us to enumerate the results. In consequence, however, of his multiplied and persevering researches, we are enabled to state, that this poison is not fatal to all animals; that it kills neither vipers, snakes, blind-worms, snails, nor leeches; that it acts very slightly on tortoises; that it is neither an acid nor an alkali; that it has no determined savour, and that it leaves in the mouth merely a sensation of astringency and stupor. It long retains its virulence in the cavity of the tooth, whether the latter be separated or not from its socket; but when dried and kept in an exposed situation, it loses its deleterious qualities in less than a year, Hence the propriety of caution in examining vipers that are stuffed or preserved in spirits, and in making use of clothes that have been bitten by them. Fontana has also proved that the poison of the viper is not uniformly fatal except to very small animals, and that it is more dangerous to the larger sorts, according to the quantity of virus secreted, the frequency of the bites, the different parts of the body on which they have been inflicted, and probably also, the higher temperature of the atmosphere. A sparrow dies in five or eight minutes, a pigeon in eight or twelve, a cat sometimes recovers, and a sheep very often; so that a man has little reason to dread the consequences of a single bite in the climate of Italy, and still less so in France or Great Britain. The hundredth part of a grain of poison applied to a muscle will kill a sparrow, whereas six times that quantity are required to kill a pigeon. According to this estimate, about three grains should prove fatal to a man, and 12 to an ox. But the vesicles of an ordinarily sized viper seldom contain more than two grains of poison, and even that quantity is not exhausted till after repeated bites. The poison is of a gummy consistency, and seems to act by destroying the irritability of the muscular fibre, Miscellaneous Observations. fibre, and introducing into the fluids a principle of putrefaction. It may be swallowed with impunity, provided there be no wound in the mouth; but if introduced into the blood, the most violent and convulsive agonies ensue, the sanguiferous system becoming coagulated, and the whole animal frame relaxed. Hence, powerful sudorifics, as the flesh of the viper itself, of snakes and lizards, which contain a large proportion of ammoniacal soap, the volatile alkali, and its various preparations, with numerous plants which excite copious perspiration, have been recommended, and often successfully used as antidotes, especially when their exhibition has been preceded by a tight ligature immediately above the wound, and by scarification and caustics.

On the effects and cure of the poison of snakes, some valuable observations and reflections occur in Dr Russell's splendid work on Indian serpents. The judicious author remarks, that when the poison is applied to brute animals, its progress is often so very rapid as hardly to leave time for the operation of medicine, or the application of any means whatever, with a probability of success. When the progress is slower, should the remedy be administered before unequivocal symptoms have removed all doubt of the poison having taken effect, recovery may be ascribed to the medicine given, whilst, in reality, no malady existed; and if deferred till doubts are removed, the remedy which, if applied in time might have proved efficacious, may be unjustly regarded as useless. Besides, it is well known that a bite of the most noxious snake does not constantly prove fatal, and that even some of the more tender animals, without the use of any remedy, recover in cases where the symptoms are apparently very formidable. These symptoms, in the bodies of different animals, are very much alike, and proceed nearly in the same order of progression, though with different degrees of rapidity.

The American Indians either suck the wound, or apply to it chewed tobacco, or make several incisions around it, which they fill with gunpowder, and then fire it off. During the progress of the cure they have likewise recourse to several pounded and bruised plants, as to some of the species of *lactuca*, the root of *prenanthes alba*, the stems and leaves of a species of *helianthus*, and in desperate cases the radical bark of the tulip-tree. In general they are partial to the use of the syngenesious plants, and to the bark of the trunk and roots of various trees.

The experiments of Bernard de Jussieu, Lebeau, Sonnini, and Bosc, seem to have established that, of all known remedies for the bite of the viper and the rattlesnake, the most efficacious are, the volatile alkali, or *eau de luce*, with suction and scarification of the recent wound.

In addition to these methods of cure, we shall quote the prescription of Dr Moseley, who spent 12 years in the West Indies.

"The bites and stings of all venomous animals are cured by the same local means, which are very simple if they were always at hand. The injured part must be instantly destroyed or cut out. Destroying it is the most safe, and equally certain; and the best application for that purpose is the *lapis infernalis*, or butter of antimony. These are preferable to a hot iron which the ancients used, because a hot iron forms a crust, which acts as a defence to the under parts instead of destroying them. The *lapis infernalis* is much better than any other, as it melts and penetrates during its application. The bitten part must be destroyed to the bottom, and where there is any doubt that the bottom of the wound is not sufficiently exposed, butter of antimony should be introduced to it on the following day, as deep as possible; and incisions should be made to lay every part open to the action of these applications. Besides destroying, burning, or cutting out the part, incisions should be made round the wound, to prevent the communication of the virus. The wound is to be dressed for some time with poultices, to assuage the inflammation caused by the caustics; and afterwards with acrid dressings and hot digestives to drain the injured parts.

"Where the above-mentioned caustics cannot be procured, corrosive sublimate, oil of vitriol, aquafortis, spirit of salt, common caustic, or a plaster made of quicklime and soap, may be applied to the wound. Gunpowder laid on the part and fired, has been used with success. When a person is bitten remote from any assistance, he should make a tight ligature above the part until proper application can be made. The Spanish writers say, that the *habilla de Carthagena*, or Carthagena bean, is a specific for poisonous bites taken inwardly.

Dr Moseley then proceeds to state the ample testimony of Ulloa in favour of this bean, which is found in great abundance in the West India islands, under the name of *antidote* or *cocoon antidote*. "I have been informed (adds he) by some intelligent Indians, that any of the red peppers, such as bird pepper or bell pepper, or what is called *Cayenne pepper*, powdered, and taken in a glass of rum, as much as the stomach can possibly bear, so as to cause and keep up for some time great heat and inflammation in the body, and a vigorous circulation, will stop the progress of the poison of serpents, even after its effects are visible; and that the bitten part only afterwards mortifies and separates, and that the patient, with bark, wine, and cordials, soon recovers."

139 Preservation of serpents. The naturalist who collects serpents for the purpose of preserving them in his cabinet, should have recourse to various precautions, which, though several of them are sufficiently obvious, are, at the same time, too often neglected. In general the hurtful sorts are caught with the greatest safety and dexterity by natives of the country in which they abound. The want of the head in many of the larger stuffed specimens from Guiana, &c. renders them of little value in a scientific point of view, and is the result of superfluous trouble to travellers who send them to Europe in this mutilated condition. Collectors, therefore, should carefully instruct their agents to preserve this part of the animal. As these larger specimens cannot easily be prepared without an incision in the skin, it will be of consequence to make this incision on the side, beginning at the termination of the plates, and not cutting across them, as is too often done, to the great prejudice of distinct classification. When the skin is once stripped, it may be carefully rolled up, and stuffed in the preparation room in the usual manner.

The smaller species of serpents may be kept in prepared spirits. Pure alcohol and spirituous liquors, especially when not reduced by water, frequently affect the most

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most brilliant animal colours. Thus, in the ordinary cabinet liquors, the fine red of the hæmachate snake degenerates into a dark brown, scales of a bright green or blue become somewhat pale, yellow always whitens, and orange changes to red or pale. White, brown, black, purple, mother of pearl, and metal-coloured scales are not liable to change. The following is an approved recipe for preserving the various colours of serpents entire.

Take very pure spring water, saturate it with alum, then mix with it about one-fifth of its bulk of very limpid spirit of wine, pass the mixture through a paper strainer, and keep the liquor well corked up in bottles, in some cool and shady situation. Immerse the animal which you wish to preserve in a vessel filled with this liquor, and allow it to remain in it 24 hours. The vessel and its included liquor should be reserved for this preliminary process. Then remove the reptile into a cylindical vessel of fine glass, filled to three-fourths of its height with the liquor above described, and closed with a glass cover. Lute the latter with mastic and hogs grease; put the vessel on a shelf that is sheltered from heat and the solar rays; and at the end of two months, if the mastic be dry, and you wish the jar to remain closed, paint the luting with an oil colour; but if you intend to open it frequently, use only the hogs grease.

Reptiles may also be conveniently preserved according to the method indicated by Chaussier, in the *Bulletin des Sciences*, (for Prairial, year 10, N° 63.), without the previous trouble of preparing the skin. All that is required, is to stuff the cavities with cotton, and to immerse the body in distilled water, saturated with super-oxygenated muriate of mercury; and when it has sufficiently imbibed the saline solution in all its parts, to allow it to dry slowly in a well aired situation, screened from the sun and dust. All the parts of the animal harden, and are thus defended from the voracity of insects, and corruption of every kind.

EXPLANATION OF PLATES CCCLXXI, CCCLXXII, CCCLXXIII, AND CCCLXXIV.

Fig. 1. Carinated Scale.
— 2. Plain Scale.
— 3. Tail of Coluber Snake.
— 4. Tail of Boa.
— 5. Fang or Tooth through which the poison is conveyed.
Fig. 6. The head of poisonous snake furnished with fangs, *a a a a*.
Fig. 7. The head of innoxious snake without fangs.
— 8. *Crotalus Horridus*, Banded Rattle-Snake.
— 9. *Boa Constrictor*.
Fig. 10. *Coluber Berus*, Common Viper.
— 11. —— *Cerastes*.
— 12. —— *Laticaudatus*, Colubrine Hydrus.
— 13. *Langaya Nasuta*, Snouted Langaya.
— 14. *Acrochordus Javanicus*, Javan Acrochordus.
Fig. 15. *Anguis Corallinus*, Coral Slow-worm.
— 16. *Amphisbæna Alba*, White Amphisbæna.
— 17. ———— *Fuliginosa*, Fuliginous Amphisbæna.
Fig. 18. *Cæcilia Tentaculata*, Eel-shaped Cæcilia.

INDEX.

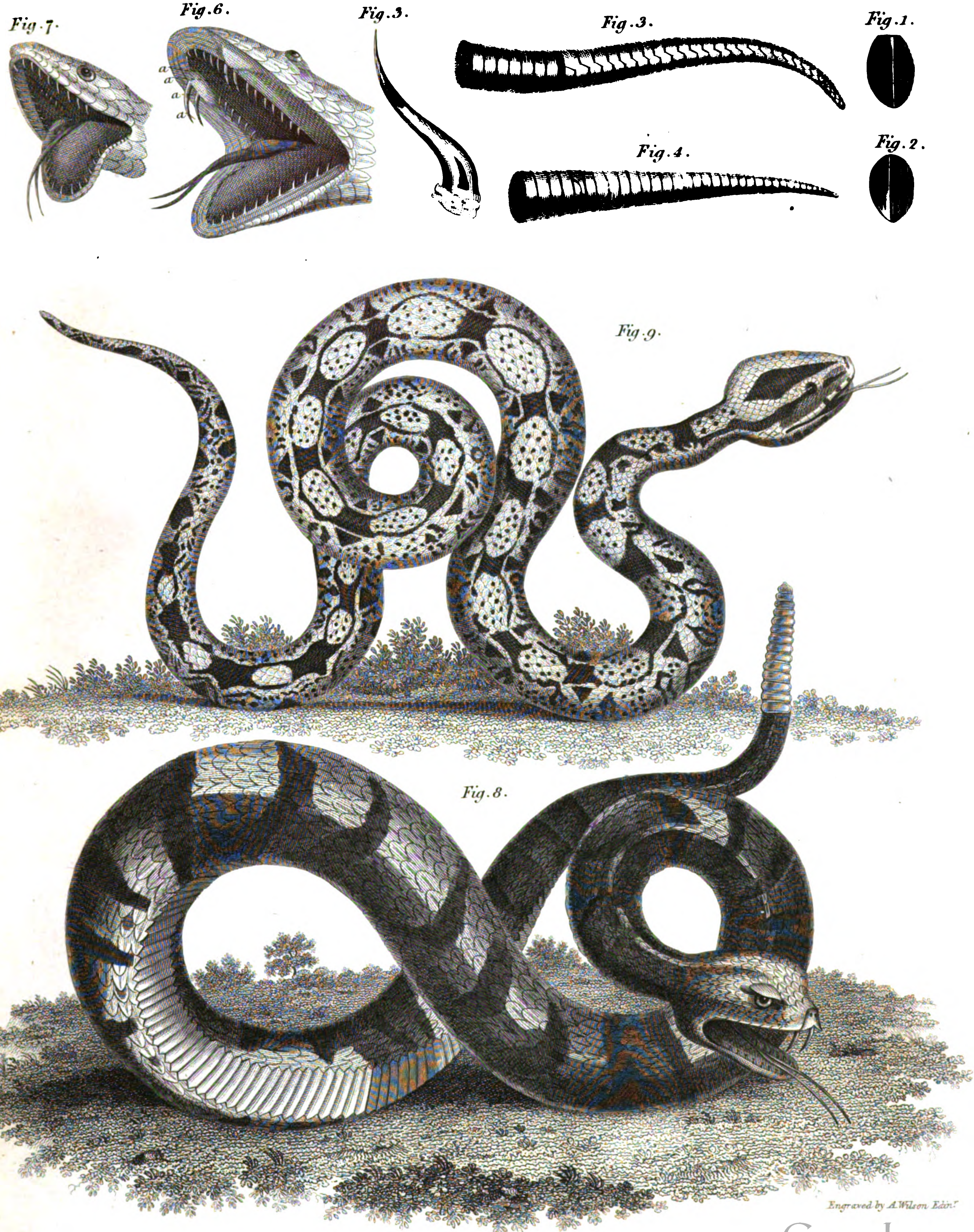
Fig. 7.
Fig. 6.
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Fig. 3.
Fig. 3.
Fig. 1.
Fig. 4.
Fig. 2.
Fig. 9.
Fig. 8.
Engraved by A. Wilson Edinr.

OPHIOLOGY. PLATE CCCLXXII.

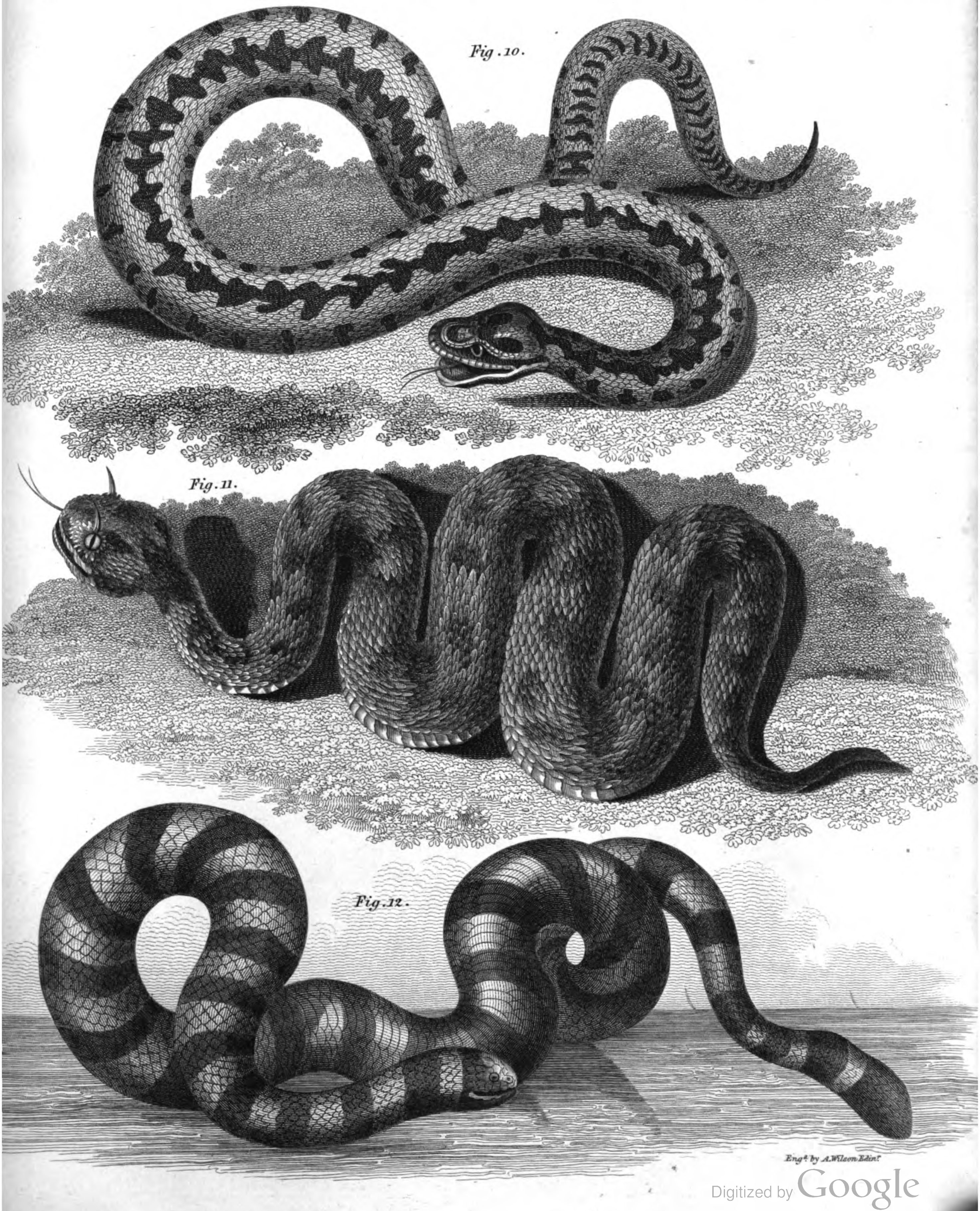


Fig. 13.

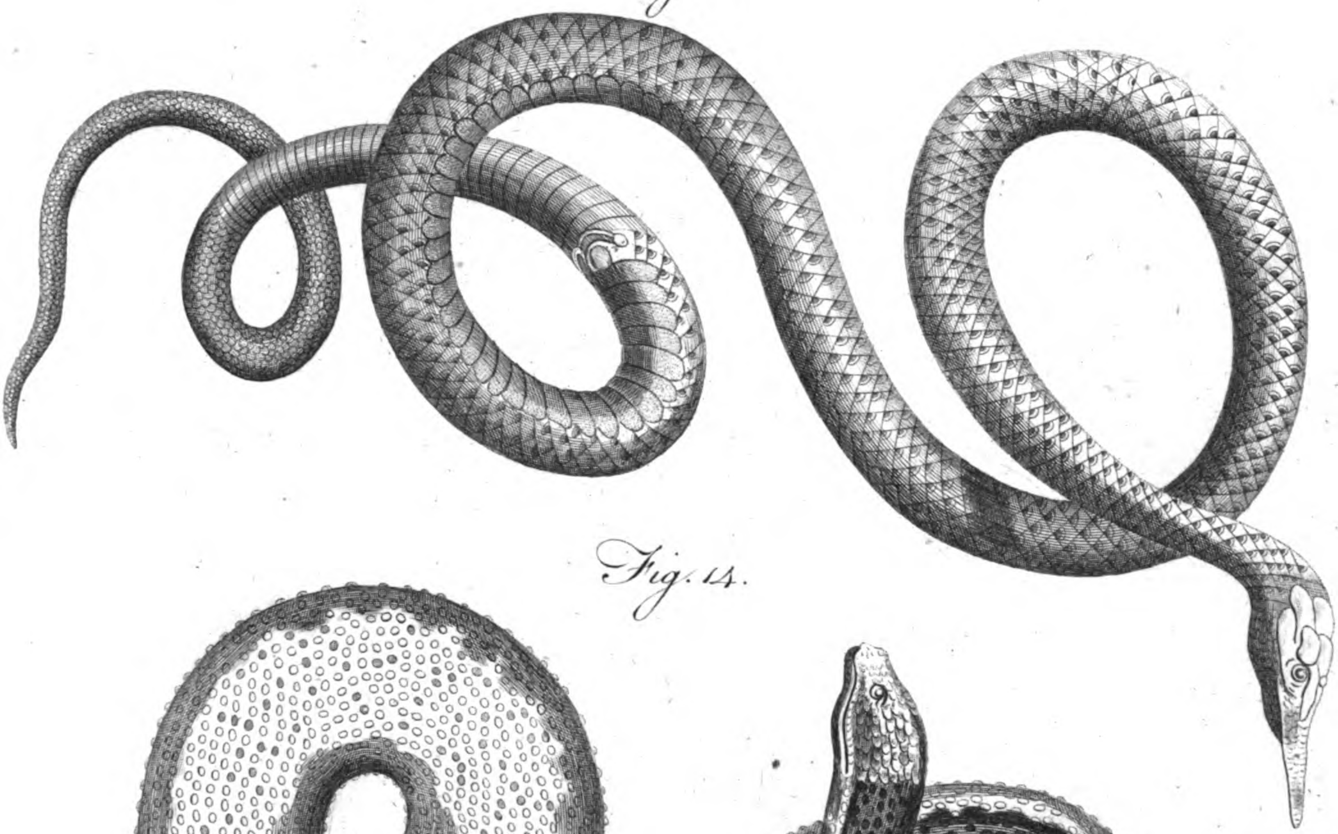


Fig. 14.

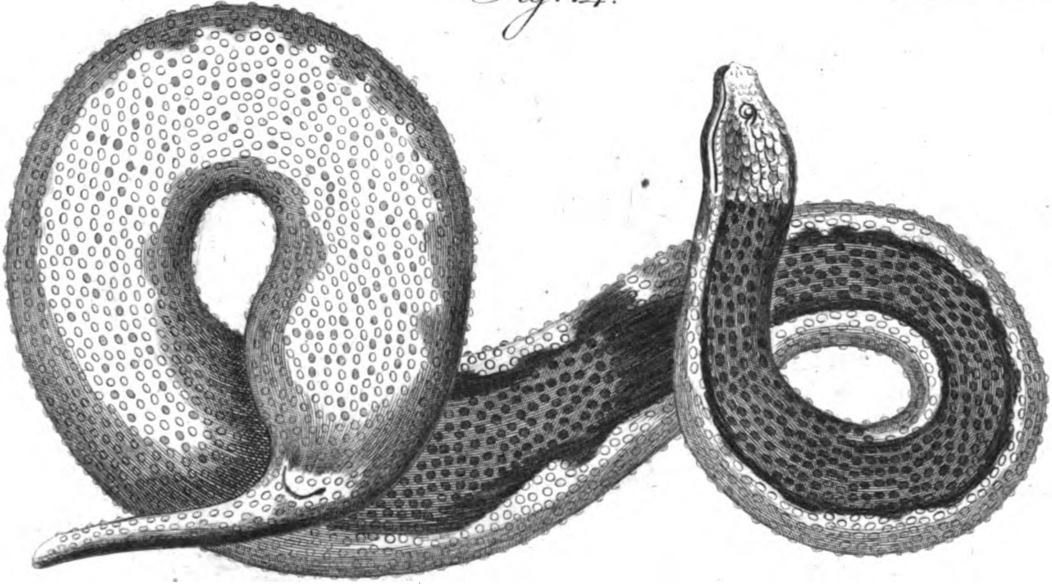
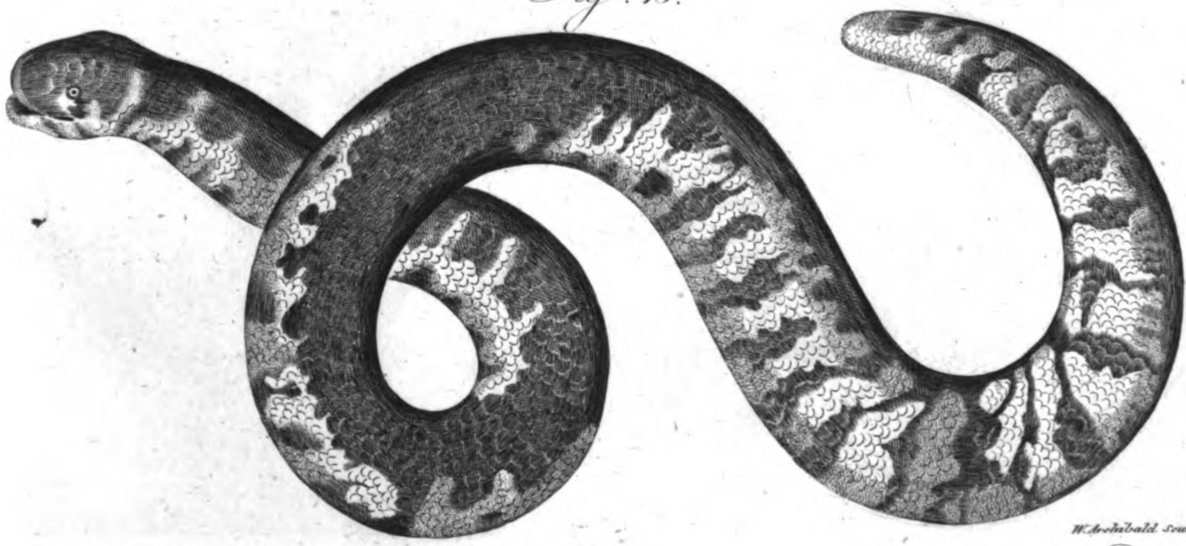


Fig. 15.



W. Archibald Sculp.

Fig. 16.

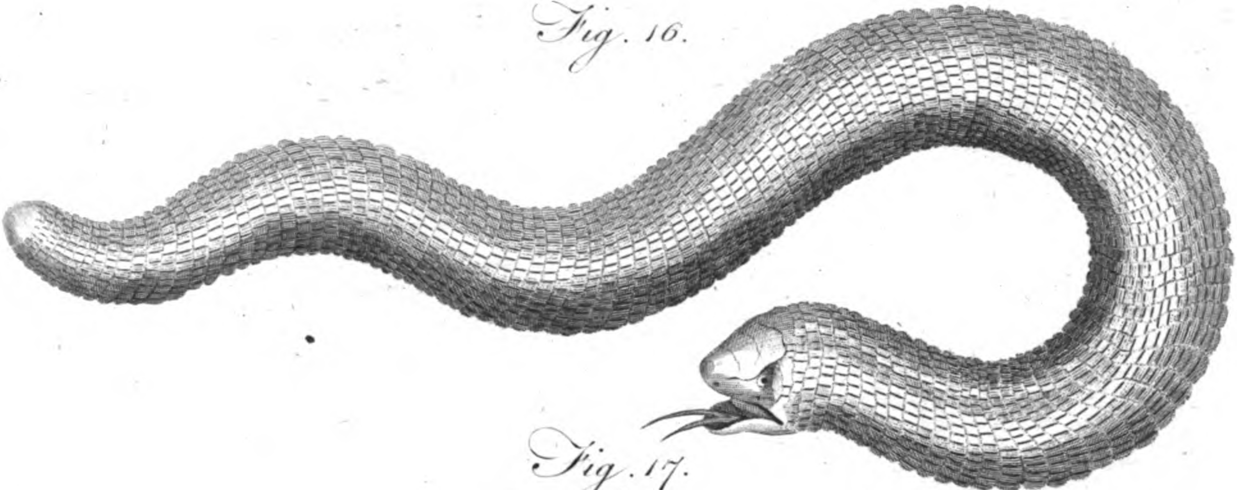


Fig. 17.

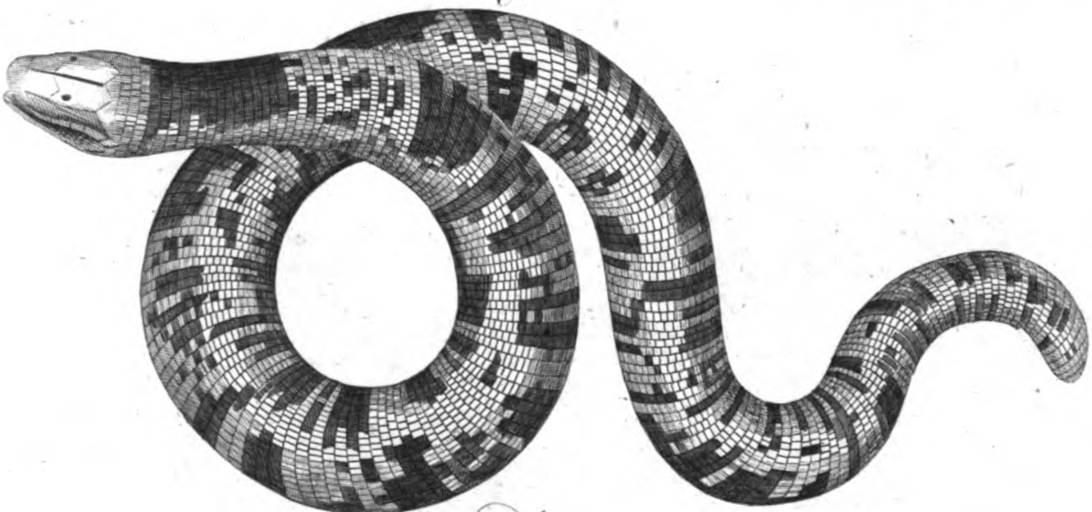
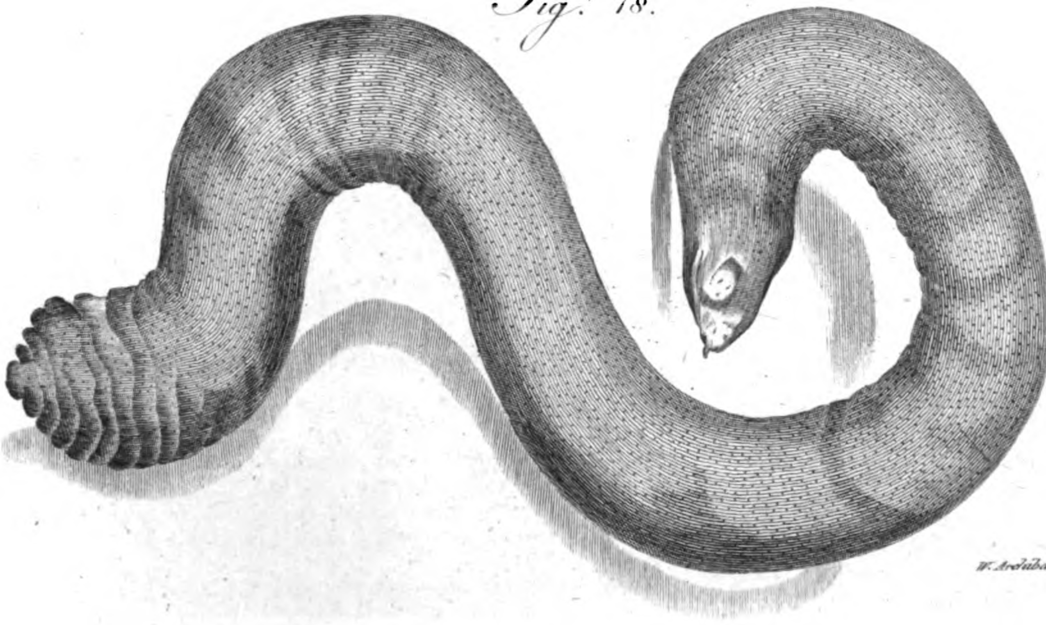


Fig. 18.



W. Archibald Sculp.

Ophiomancy || Ophir.

OPHIOMANCY, in antiquity, the art of making predictions from serpents. Thus Calchas, on seeing a serpent devour eight sparrows with their dam, foretold the duration of the siege of Troy: and the seven coils of a serpent that was seen on Anchises's tomb, were interpreted to mean the seven years that Æneas wandered from place to place before he arrived at Latium.

OPHIORHIZA, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 47th order, *Stellatæ*. See BOTANY *Index*.

OPHIOXYLON, a genus of plants belonging to the polygamia class, and in the natural method ranking with those of which the order is doubtful. See BOTANY *Index*.

1 Different hypotheses respecting the situation of Ophir.

OPHIR, a country mentioned in Scripture, from which Solomon had great quantities of gold brought home in ships which he sent out for that purpose; but where to fix its situation is the great difficulty, authors running into various opinions on that head. Some have gone to the West, others to the East Indies, and the eastern coast of Africa, in search of it.—Mr Bruce the celebrated Abyssinian traveller, has displayed much learning and ingenuity in settling this question of Biblical history. To the satisfaction of most of his readers, he has determined Ophir to be Sofala, a kingdom of Africa, on the coast of Mosambique, near Zanguebar (see SOFALA). His reasons for this determination are so generally known, that it would be improper to repeat them here at length; because such as are not already acquainted with them may consult his book, which has been long in the hands of the public. He justly observes, that in order to come to a certainty where this Ophir was, it will be necessary to examine what Scripture says of it, and to keep precisely to every thing like description which we can find there, without indulging our fancy farther. *1st*, Then, the trade to Ophir, was carried on from the Elanitic gulf through the Indian ocean. *2dly*, The returns were gold, silver, and ivory, but especially silver †. *3dly*, The time of the going and coming of the fleet was precisely three years ‡, at no period more or less.

2 Hypothesis of Mr Bruce.

† 1 Kings, x. 22.

‡ 1 Kings, x. 22. 2 Chron. ix. 21.

Now, if Solomon's fleet sailed from the Elanitic gulf to the Indian ocean, this voyage of necessity must have been made by monsoons, for no other winds reign in that ocean. And what certainly shows this was the case, is the precise term of three years in which the fleet went and came between Ophir and Ezion gaber.

These mines of Ophir were probably what furnished the East with gold in the earliest times: great traces of excavation must therefore have appeared.

Ophir.

But John dos Santos says, that he landed at Sofala in the year 1586; that he sailed up the great river Cuama as far as Tete, where, always desirous to be in the neighbourhood of gold, his order had placed their convent. Thence he penetrated for about two hundred leagues into the country, and saw the gold mines then working at a mountain called *Afura*. At a considerable distance from these are the silver mines of Chicoua; at both places there is a great appearance of ancient excavations; and at both places the houses of the kings are built with mud and straw, whilst there are large remains of massy buildings of stone and lime.

3 Arguments in support of it.

Every thing then conspires to fix the Ophir of Solomon in the kingdom of Sofala, provided it would necessarily require neither more nor less than three years to make a voyage from Ezion-gaber to that place and Tarshish and return. To establish this important fact, our author observes, that the fleet or ship for Sofala, parting in June from Ezion-gaber (see EZION-GABER), would run down before the northern monsoon to Mocha (see MOCHA). Here, not the monsoon, but the direction of the gulf, changes; and the violence of the south-westers, which then reign in the Indian ocean, make themselves at times felt even in Mocha roads. The vessel therefore comes to an anchor in the harbour of Mocha; and here she waits for moderate weather and a fair wind, which carries her out of the straits of Babelmandel, through the few leagues where the wind is variable.

Her course from this is nearly south-west, and she meets at Cape Guardafui, a strong south-wester that blows directly in her teeth. Being obliged to return into the gulf, she mistakes this for a trade-wind; because she is not able to make her voyage to Mocha but by the summer monsoon, which carries her no farther than the straits of Babelmandel, and then leaves her in the face of a contrary wind, a strong current to the northward, and violent swell.

The attempting this voyage with sails, in these circumstances, was absolutely impossible, as their vessels went only before the wind: if it was performed at all, it must have been by oars; and great havock and loss of men must have been the consequence of the several trials.

At last, philosophy and observation, together with the unwearied perseverance of man bent upon his own views and interests, removed these difficulties, and showed the mariners of the Arabian gulf, that these periodical winds,

Ophir.

winds, which in the beginning they looked upon as invincible barriers to the trading to Sofala, when once understood, were the very means of performing this voyage safely and expeditiously.

The vessel trading to Sofala sailed from the bottom of the Arabian gulf in summer, with the monsoon at north, which carried her to Mocha. There the monsoon failed her by the change of the direction of the gulf. The south-west winds, which blow without Cape Guardafui in the Indian ocean, force themselves round the cape so as to be felt in the road of Mocha, and make it uneasy riding there. But those soon changed, the weather became moderate, and the vessel, we suppose in the month of August, was safe at anchor under Cape Guardafui, where was the port which, many years afterwards, was called *Promontorium Aromatum*. Here the ship was obliged to stay all November, because all these summer months the wind south of the cape was a strong south-wester, as hath been before said, directly in the teeth of the voyage to Sofala. But this time was not lost; part of the goods bought to be ready for the return was ivory, frankincense, and myrrh; and the ship was then at the principal mart for these.

Our author supposes, that in November the vessel sailed with the wind at north-east, with which she would soon have made her voyage: but off the coast of Melinda, in the beginning of December, she there met an anomalous monsoon at south-west, in our days first observed by Dr Halley, which cut off her voyage to Sofala, and obliged her to put into the small harbour of Mocha, near Melinda, but nearer still to Tarshish, which we find here by accident, and which we think a strong corroboration that we are right as to the rest of the voyage. In the annals of Abyssinia, it is said that Amda Sion, making war upon that coast in the 14th century, in a list of the rebellious Moorish vassals, mentions the chief of Tarshish as one of them, in the very situation where we have now placed him.

Solomon's vessel, then, was obliged to stay at Tarshish till the month of April of the second year. In May, the wind set in at north-east, and probably carried her that same month to Sofala. All the time she spent at Tarshish was not lost, for part of her cargo was to be brought from that place; and she probably bought, bespoke, or left it there. From May of the second year, to the end of that monsoon in October, the vessel could not stir; the wind was north-east. But that time, far from being lost, was necessary to the traders for getting in their cargo, which we shall suppose was ready for them.

The ship sails on her return, in the month of November of the second year, with the monsoon south-west, which in a very few weeks would have carried her into the Arabian gulf. But off Mocha, near Melinda and Tarshish, she met the north-east monsoon, and was obliged to go into that port, and stay there till the end of that monsoon; after which a south-wester came to her relief in May of the third year. With the May monsoon she ran to Mocha within the straits, and was there confined by the summer monsoon blowing up the Arabian gulf from Suez, and meeting her. Here she lay till that monsoon which in summer blows northerly from Suez, changed to a south-east one in October or November, and that very easily brought her up into the Elanitic gulf, the middle or end of December of the third year. She had no need of more time to complete her voyage, and it was not possible she could do it in less.

Such is a very short and imperfect abstract of our author's reasons for placing Ophir in Sofala. If it excite the curiosity of our readers to consult his work, it will answer the purpose for which we have made it.

4 Another hypothesis.

We are now to give another ingenious conjecture concerning the situation of Ophir and Tarshish, with which we have been favoured by Dr Doig, the learned author of Letters on the Savage State, addressed to Lord Kames.

This respectable writer holds that Ophir was somewhere on the west coast of Africa, and that Tarshish was the ancient Bætica in Spain. His essay is not yet published; but he authorizes us to give the following abstract of it: "The first time that *Ophir*, or rather *Aufir*, occurs in Scripture, is in Gen. x. 29. where the sacred historian, enumerating the sons of Joktan, mentions Aufir as one of them." According to his account, the descendants of those 13 brothers settled all in a contiguous situation, from Mesha (the Mocha of the moderns) to Sepharah, a mountain of the east. Moses, as every one knows, denominates countries, and the inhabitants of countries, from the patriarch from whom those inhabitants descended. In describing the course of one of the branches of the river of paradise, the same Moses informs us that it encompassed the whole land of Havilah, &c. which abounded with fine gold, bdellium, and the onyx stone; and this land had its name from Havilah, the 12th son of the patriarch Joktan. *Ophir* or *Aufir* was Havilah's immediate elder brother; and of course the descendants of the former, in all probability, fixed their habitation in the neighbourhood of those of the latter. If, then, the land of Havilah abounded with gold and precious stones, the land of Ophir undoubtedly produced the very same articles.

5 The original Ophir not the Ophir of Solomon; of which

Here then we have the original Ophir; here was found the primary gold of Ophir; and here lay the Ophir mentioned in Job xi. 24. But as navigation was then in its infant state, the native land of gold mentioned by Job must have been much nearer home than that to which the fleets of Solomon and Hiram made their triennial voyages. That several countries on the south-east coast of Africa abounded with gold long after the era of Job, is evident from the testimony of Herodotus, Strabo, Diodorus Siculus, Ptolemy, Pomponius Mela, &c.; but that in these countries the Ophir of Solomon could not be situated, is plain, because his ships in the same voyage touched at Tarshish, which lay in a very different quarter.

The Abyssinian traveller has placed this *regio aurifera* in Sofala on the eastern coast of Africa, nearly opposite to the island of Madagascar. This hypothesis was current a hundred years before he was born; but I am persuaded (says our author) that it is not tenable. The Ophir of Solomon, in whatever part of Africa it lay, must have been well known, prior to his reign, both to the Phœnicians and the Edomites. These people navigated that monarch's fleet, and therefore could be no strangers to the port whither they were bound. That it

2

Ophir.

it was in Africa is certain; and that it was on the west coast of that immense peninsula, will appear more than probable, when we have ascertained the situation of Tarshish, and the usual course of Phoenician navigation. To these objects, therefore, we shall now direct our inquiries.

6 the situation must be ascertained by discovering that of Tarshish.

"Javan, the fourth son of the patriarch Japhet, had four sons, Elisha, *Tarshish*, Kittim, and Dodanim or Rodanim; among whose 'descendants were the isles of the Gentiles divided.' The city of *Tarsus* on the coast of Cilicia, at once ascertains the region colonized by the descendants of Tarshish. But as much depends upon determining the position of this country, I shall endeavour (says the Doctor) to fix it with all possible precision.

"In the first place, I must beg leave to observe, that there is not a single passage in any ancient author, sacred or profane, that so much as alludes to any city, district, canton, or country, of the name of Tarshish in the eastern parts of the world. The descendants of Javan, of whom Tarshish was one, are agreed on all hands to have extended their settlements towards the north-west, i. e. into Asia Minor, Italy, and Spain. The inhabitants of Tarshish are everywhere in Scripture said to be addicted to navigation and commerce, in which they seem to have been connected with the Tyrians and Phoenicians †, who were always said by the Jews to inhabit the isles of the sea. Indeed, in Hebrew geography, all the countries towards the north and west, which were divided from Judea by the sea, were called the isles of the sea‡. Thus Isaiah: 'The burden of Tyre. Howl ye ships of Tarshish, for it is laid waste, so that there is no house, no entering in: from the land of Chittim it is revealed unto them. Be still ye inhabitants of the isle, thou whom the merchants of Zidon, that pass over the sea, have replenished.' The land of Chittim was Macedonia, and often Greece, from which every one knows that the destruction of Tyre came; and that Tarshish was not an unconcerned spectator of that destruction, is obvious from the same prophet, who proceeds to say||: 'As at the report concerning Egypt, so shall they be sorely pierced at the report concerning Tyre. Pass over to Tarshish; howl ye inhabitants of the isle. Is this your joyous city?' It appears likewise from Ezekiel xxvii. 12. that Tarshish was the merchant with whom Tyre traded for silver, iron, tin, and lead, and that this trade was carried on in fairs.

† Ps. xlviii. 7. lxxii. 10.

‡ Gen. ii. 26.

|| Is. xxiii. *passim.*

7 The original Tarshish, where situated.

"From all these passages, it seems to be evident, that the descendants of Tarshish settled on the western coast of Asia Minor; that these people were addicted to navigation and commerce; that in the course of their traffic they were connected with the Tyrians and Phoenicians; that the commerce they carried on consisted of silver, iron, tin, and lead; that the people of Tarshish were connected with Kittim and the isles of the Gentiles, which are confessedly situated toward the north and west of Judea.

"But lest, after all, a fact so fully authenticated should still be called in question, I shall add one proof more, which will place the matter beyond the reach of doubt and controversy.

"When the prophet Jonah intended to flee from the presence of the Lord, in order to avoid preaching at Nineveh, let us see where the peevish deserter embarked (Jonah i. 3.). "And Jonah rose up to flee unto Tarshish, from the presence of the Lord, and went down to Joppa: and he found a ship going to Tarshish, and he paid the fare thereof, and went down into it, to go with them into Tarshish, from the presence of the Lord.' Every body knows that Joppa or Japhah stood upon the shore of the Mediterranean; of course the fugitive prophet had determined to go to some very distant region westward, and by that means to get as far from Nineveh as possible."

8 This not the Tarshish of Solomon.

Having thus proved to a demonstration, that the original Tarshish was a region on the western coast of Asia Minor, where either the patriarch of that name, or some of his immediate descendants, planted a colony, it remains to determine whether this was actually the country from which Solomon imported the vast quantities of silver mentioned by the sacred historian. That it was not, our author frankly acknowledges; and therefore, says he, we must look out for Solomon's Tarshish in some other quarter of the globe.

9 The name of one country transferred to another.

To pave the way for this discovery, he very justly observes, that it has at all times been a common practice to transfer the name of one country to another, in consequence of some analogy or resemblance between them. It has likewise often happened, that when a commodity was brought from a very distant country by a very distant people, the people to whom it was imported have taken it for granted that it was produced in the region from which it was immediately brought to them. Of the truth of this position no man acquainted with the Greek and Roman poets can for a moment entertain a doubt. Hence the *Assyrium amomum* of Virgil, and the *Assyrium malabathrum* of Horace, though these articles were the product not of Assyria but of India. The Jews, who were as little acquainted with foreign countries as the Greeks and Romans, had very probably the same notions with them respecting articles of commerce; and if so, they would undoubtedly suppose, that the silver sold by the merchants of Tarshish was the product of that country. When this mistake came to be discovered, they very naturally transferred the name *Tarshish* from the country of the merchants to that of the articles which they imported. Let us now, says our author, try if we cannot find out where that country was.

It has been already shown, by quotations from Isaiah and Ezekiel, that the merchants of Tarshish traded in the markets of Tyre with silver, iron, lead, and tin. To these authorities, we shall add another from Jeremiah: "Silver (says that prophet) spread into plates is brought from Tarshish." "But in Spain (continues our learned dissertator), all those commodities were found in the greatest abundance. All the ancient authors who describe that region dwell with rapture on its silver mines. This fact is too generally known to need to be supported by authorities. Spain was then the region which furnished Solomon's traders with the immense mass of silver he is said to have imported. This was, one might say, the modern Tarshish; and indeed both Josephus and Eusebius are positive that the posterity of Tarshish actually peopled that country. If this was an early opinion, as it certainly was, the Jews would of course denominate Spain from the patriarch in question.

I have shown above, that the inhabitants of Tarshish.

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shish were strictly connected with the Kittim, or Grecians: I shall here produce an authority which will prove to a demonstration that the Kittim had extended their commerce into that part of Africa now called Barbary.

"The prophet Ezekiel, (xxvii. 6.) describing the splendour and magnificence of Tyre, tells us, 'that the company of the Ashurites made her benches of ivory, brought from the isles of Kittim.' In the first place, I must observe, that there is probably a small error in the orthography of the word Ashurim. This term is everywhere in Scripture translated Assyrians, which translation is certainly just. But how the Assyrians could export ivory from the isles of Kittim, and fashion it into benches for the Tyrian mariners, is, in my opinion, a problem of no easy solution. The fact is Ashurim should be Asherim, that is, the company of the men of Asher. The tribe of Asher obtained its inheritance in the neighbourhood of Tyre; (see Josh. xix. 28.). 'And Hebron, and Rehob, and Hammon and Canah, unto Zidon the great.' The companies of the tribe of the Asherites then, and not the Ashurim, were the people who manufactured the benches in question.

"Be that as it may, the ivory of which the implements were formed was imported from the isles of Kittim, that is, from Greece and its neighbourhood. These islands, it is certain, never produced ivory. They must therefore have imported it from some other country; but no other country, to which the Greeks and their neighbours could have extended their commerce, except the north of Africa, produced that commodity. The conclusion then is, that the maritime states of Asia Minor, Greece, and probably the Hetruscans on the west coast of Italy, carried on a gainful commerce with Spain and Barbary at a very early period.

"We have now seen that the original Tarshish on the coast of Asia Minor did not produce the metals imported by Solomon's fleet; that no Tarshish is to be found in the eastern parts of the globe; that the Tarshish we are in quest of was undoubtedly situated somewhere towards the west of Judea: we have shown that the mercantile people of Asia Minor, Greece, and probably of Italy, actually imported some of those articles from the coast of Africa; we have hazarded a conjecture, that Spain was the modern Tarshish, and that very country from which Solomon imported his silver, and the Tyrians their silver, iron, tin, and lead. Let us now make a trial whether we cannot exhibit some internal proofs in support of the hypothesis we have above adopted.

"The ancients divided Spain into three parts, Bætica, Lusitania, and Tarraconensis. Bætica is the modern Andalusia. It stretched along the Fretum Herculeum, or Straits of Gibraltar, to the mouth of the Guadalquiver. This region is thought by some to have been the Elysian fields of the poets. The river Bætis, which divides it, is called *Tartessus* by Aristotle, Stesichorus, Strabo, Pausanias, Steph. Byzant, and Avianus. Here too we have a city and a lake of the same name. But Tartessus is positively the very same with Tarshish. The Phœnicians, by changing *schin* into *thau*, made it Tartish. The Greeks manufactured the rest, by changing Tartish into Tartis, and in process of time into ταρτησσος. That the Phœnicians actually changed *schin* into *thau* is certain; for Plutarch tells us, in the life of Sylla, that in their language an ox was called *thor*, which is, no doubt, the same with the Hebrew *shor*.

"From this deduction, it appears highly probable at least, that the Spanish Bætica was originally called *Tarshish*. Indeed this similarity of names has operated so powerfully on the learned Bochart, and on some other moderns of no mean figure, that they have positively affirmed, as Josephus had done before them, that the patriarch Tarshish actually settled in that country. This I should think not altogether probable; but that his descendants who settled on the coast of Asia Minor colonized Bætica, and carried on an uninterrupted commerce to that country, along with the Phœnicians, for many centuries after it was peopled, and that from the circumstances above narrated, it was denominated *Tarshish*, are facts too palpable to admit of contradiction. 10 Tarshish Spanish Bætica.

"Let us now see whether this Bætica, where I have endeavoured to fix the situation of the Tarshish of the Scriptures, was actually furnished with those articles of commerce which are said to have been imported from that country. To enlarge on this topic would be altogether superfluous. Diodorus Siculus, Strabo, Polybius, Pliny, Solinus, and, in one word, all the Greek and Roman historians who have mentioned that region, have unanimously exhibited it as the native land of silver, iron, and tin: to these, contrary to the opinions of the celebrated modern traveller, they likewise add gold in very large quantities."

Our author having thus ascertained the situation of Tarshish, proceeds to prove, by a mass of evidence too large for our insertion, that the Edomites and Tyrians had doubled the Cape, and almost encompassed Africa, long before the era of Solomon. Then referring to 1 Kings, chap. ix. and x. 2 Chron. viii. ix. 2 Kings xxii. and 2 Chron. xx. he observes, that from these authorities it appears indubitable, that the fleets of Solomon and Hiram sailed from Eloth and Eziongeber; that the voyages to Ophir and Tarshish were exactly the same, performed at one and the same time, by the very same fleet; which must necessarily have encompassed the peninsula of Africa before it could arrive at the country of Tarshish. This being the case, the traders might easily enough collect the gold on the coast of Guinea, or on what is now vulgarly called the *Gold Coast*. The ivory they might readily enough procure on the Barbary coast, opposite to Tarshish. In Africa too, they might hunt apes, monkeys, baboons, &c.; and peacocks, or rather parrots, and parroquets, they might surprise in the forests which abounded on the coast. In Spain, silver, iron, lead, and tin, were, one may say, the native produce of the soil. Even at this early period, the Phœnician navigators had discovered the Cassiterides or Scilly islands, and Cornwall; and from that region, in company with the merchants, may have supplied them with that rare commodity.

"I have supposed that the navy of Solomon and Hiram collected their gold in the course of their voyage somewhere on the coast of Africa, beyond the Cape, for the following reasons: Had they found the golden fleece

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fleece at Sofala (A), or any part of the coast of Africa, they would have chosen to return and unlade at Eloth or Ezion-geber, rather than pursue a long and dangerous course, quite round Africa, to Tarshish; to which last country they might have shaped their course much more commonly from Zidon, Tyre, Joppa, &c. But being obliged to double the cape in quest of some of those articles which they were enjoined to import, they pushed onward to Tarshish, and returned by the Pillars of Hercules to Tyre, or perhaps to Joppa, &c. Their next voyage commenced from one or other of these ports, from which they directed their course to Tarshish; and having taken in part of their lading there, they afterwards coasted round Africa, and so arrived once more at Eloth or Ezion-geber.

"Let us now attend to the space of time in which these voyages were performed. We are told expressly (2 Chron. ix. 21.) that once every three years came the ships of Tarshish, &c. This is exactly the time one would naturally imagine necessary to perform such a distant voyage, at a period when navigation was still in its infancy, and mariners seldom adventured to lose sight of the coast. Of this we have an irrefragable proof in the history of a voyage round the very same continent, undertaken and accomplished in the very same space of time, about two centuries after.

"We learn from Herodotus, lib. ii. cap. 149. that Nechus, one of the latter kings of Egypt, whom the Scripture calls *Pharaoh Necho*, built a great number of ships, both on the Red sea and the Mediterranean. The same historian, lib. iv. cap. 42. informs us, that this enterprising monarch projected a voyage round the continent of Africa, which was actually accomplished in the space of three years. In the conduct of this enterprise, he employed Phœnician mariners, as Solomon had done before him. These, we may suppose, were assisted in the course of this navigation by charts or journals, or at least by traditional accounts derived from their ancestors: 'These navigators (says the historian) took their departure from a port on the Red sea, and sailing from thence into the southern ocean, and, in the beginning of autumn, landing on the coast of Africa, there they sowed some grain which they had carried out with them on board their vessels. In this place they waited till the crop was ripened; and, having cut it down, they proceeded on their voyage. Having spent two years in this navigation, in the third they returned to Egypt, by the Pillars of Hercules. These mariners, adds the author, reported a fact, which, for his part, he could by no means believe to be true; namely, that in one part of their course their shadows fell on their right; a circumstance which gives considerable weight to the truth of the relation.'

"Let it now be observed that Phœnician mariners navigated the fleet of Solomon: the same people conducted that of Necho: the fleet of Necho spent three years in the course of its voyage; that of Solomon did the same in its course about two centuries before: the fleet of Necho sailed from a port on the Red sea; that of Solomon took its departure from Eloth or Ezion-geber, situated on the same sea: the fleet of the former returned by the Pillars of Hercules; that of the latter, according to the hypothesis, pursued the very same route. Such a coincidence of similar circumstances united with those adduced in the preceding part of this article, seem to prove almost to a demonstration, that the navy of Hiram and Solomon performed a voyage round Africa, in that age, in the same manner as that of Necho did two centuries after.

"Upon the whole, I conclude, that the original Ophir, which is really Aufir or Aufr, was situated on the south of Arabia Felix, between Sheba and Havilah, which last was encompassed by one of the branches of the river of Paradise: that the name Ophir, i. e. Aufr, was, in consequence of its resemblance, in process of time transferred to a region on the coast of Africa; and that from it first *Afer* and then Africa was denominated: that the primitive Tarshish was Cilicia, and that the Jews applied this name to all the commercial states on the coast of Asia Minor, and perhaps of Italy, there being strong presumptions that the Tyrrhenians were colonists from Tarshish; that Bætica, and perhaps some other regions of Spain, being planted with colonies from Tarshish, likewise acquired the name of Tarshish; that the Tyrians were strictly connected with the merchants of Tarshish in their commercial enterprises; that Tarshish was certainly situated westward from Judea, Phœnicia, &c.; that no other country in the western quarters produced the commodities imported by the two kings, except Spain and the opposite coasts; that this country, in those ages, produced not only silver, iron, tin, and lead, but likewise gold in great abundance; that the merchants of Kittim imported ivory, of which the Asherites made benches for the Tyrians; which commodity they must have purchased on the coast of Barbary, where the Jews and Phœnicians would find the same article; that Tarshish being situated in Spain, it was impossible for a fleet sailing from Eloth, or Ezion-geber, to arrive at that country without encompassing Africa; that of course the fleet in question did actually encompass that continent; that the Ophir of Solomon must have been situated somewhere on the coast of Africa, to the west of the Cape, because from it the course to Tarshish was more eligible than to return the same way back to Ezion-geber."

11
Ophir situated on the coast of Africa, west of the Cape.

Our author supports this conclusion by many other arguments and authorities, which the limits prescribed us will not permit us to detail; but perhaps the article might be deemed incomplete if we did not show how he obviates an objection that will readily occur to his theory. "If the original Ophir was seated on the coast of Arabia Felix, and the modern region of the same name on the west coast of Africa, it may be made a question, how the latter country came to be denominated from the former; Nothing (says our author) can be more easy than to answer this question. The practice of adapting the name of an ancient country to

12
An objection answered.

(A) That Sofala opposite to the island of Madagascar was Ophir, was an ancient conjecture. See Bochart, chan. l. ii. cap. 27. p. 160. 4to.

to a newly discovered one, resembling the other in appearance, in situation, in figure, in distance, in the nature of the climate, productions, &c. has ever been so common, that to produce instances would be altogether superfluous. The newly discovered region on the coast of Africa abounded with the same species of commodities by which the original one was distinguished; and of course, the name of the latter was annexed to the former.

Whether Mr Bruce's hypothesis, or Dr Doig's, respecting the long-disputed situation of Solomon's *Ophir*, be the true one, it is not for us to decide. Both are plausible, both are supported by much ingenuity and uncommon erudition; but we do not think that the arguments of either writer furnish a complete confutation of those adduced by the other. *Sub judice lis est.*

OPHIRA, a genus of plants belonging to the octandria class. See BOTANY *Index*.

OPHITES, in *Natural History*, an old term employed to denote a mineral, of a dusky green ground, sprinkled with spots of a lighter green, otherwise called *serpentine*. See MINERALOGY *Index*.

OPHITES, in church history, Christian heretics, so called both from the veneration they had for the serpent that tempted Eve, and the worship they paid to a real serpent: they pretended that the serpent was Jesus Christ, and that he taught men the knowledge of good and evil. They distinguished between *Jesus* and *Christ*: Jesus, they said, was born of the Virgin, but Christ came down from heaven to be united with him; Jesus was crucified, but Christ had left him to return to heaven. They distinguished the God of the Jews, whom they termed *Jaldabaoth*, from the supreme God: to the former they ascribed the body, to the latter the soul of man. They had a live serpent, which they kept in a kind of cage; at certain times they opened the cage door, and called the serpent: the animal came out, and mounting upon the table, twined itself about some loaves of bread; this bread they broke and distributed it to the company, who all kissed the serpent: this they called their *Eucharist*.

OPHRYS, TWYBLADE; a genus of plants belonging to the gynandria class; and in the natural method ranking under the 7th order, *Orchideæ*. See BOTANY *Index*.

OPHTHALMOSCOPY, a branch of physiognomy, which deduces the knowledge of a man's temper and character from the appearance of his eyes.

OPHTHALMIA, in *Medicine*, an inflammation of the eye or of the membranes which invest it; especially of the adnata, or albugineous coat. See MEDICINE, N° 174.

OPIATES, medicines which are administered to procure sleep, whether in the form of electuaries, drops, or pills.

OPINION is that judgment which the mind forms of any proposition, for the truth or falsehood of which there is not sufficient evidence to produce science or absolute belief.

That the three angles of a plane triangle are equal to two right angles, is not a matter of *opinion*, nor can it with propriety be called an object of the mathematician's *belief*: he does more than believe it; he *knows* it to be true. When two or three men, under no temptation to deceive, declare that they were witnesses of an uncommon, though not preternatural event, their testimony is complete evidence, and produces absolute *belief* in the minds of those to whom it is given; but it does not produce *science* like rigid demonstration. The fact is not doubted, but those who have it on report do not *know* it to be true, as they know the truth of propositions intuitively or demonstrably certain. When one or two men relate a story including many circumstances to a third person, and another comes who positively contradicts it either in whole or in part, he to whom those jarring testimonies are given, weighs all the circumstances in his own mind, balances the one against the other, and lends an assent, more or less wavering, to that side on which the evidence appears to preponderate. This assent is his *opinion* respecting the facts of which he has received such different accounts.

Opinions are often formed of events not yet in being. Were an officer from the combined armies, which are just now * besieging Valenciennes, to come into the room where we are writing, and tell us that those armies are in good health and high spirits; that every shot which they fire upon the fortress produces some effect; and that they have plenty of excellent provisions, whilst the besieged are perishing by hunger; we should absolutely *believe* every fact which he had told us upon the evidence of his testimony; but we could only be of *opinion* that the garrison must soon surrender. In forming opinions of this kind, upon which, in a great measure depends our success in any pursuit, every circumstance should be carefully attended to, and our judgments guided by former experience. Truth is a thing of such importance to man, that he should always pursue the best methods for attaining it; and when the object eludes all his researches, he should remedy the disappointment, by attaching himself to that which has the strongest resemblance to it; and that which most resembles truth is called *probability*, as the judgment which is formed of it is termed *opinion*. See PROBABILITY.

OPIUM, in the *Materia Medica*, is an inspissated juice, obtained from the capsule of the white poppy, partly of the resinous and partly of the gummy kind, and possessing also a narcotic principle. See MATERIA MEDICA, N° 612.

OPOBALSAMUM, in the *Materia Medica*, Opobalsum, or balm of Gilead, a resinous substance obtained from a species of AMYRIS. See CHEMISTRY, N° 2472, and MATERIA MEDICA, N° 507.

OPOCALPASUM, OPOCARBASUM, or APOCALPASUM; a gummy resinous substance, which has a strong resemblance to liquid myrrh, and which in the time of Galen was mixed with myrrh. It was difficult, according to this writer, to distinguish the one from the other unless by their effects, the former being of a poisonous nature, which frequently produced lethargy.

OPOPONAX, in the *Materia Medica*, is a gummy resinous substance brought from the East Indies. See MATERIA MEDICA, N° 455.

OPORTO, or PORTO, a flourishing city and seaport of Portugal, in the province of Entre-Douero-e-Minho, with a bishop's see. Nature has rendered it almost impregnable; and it is justly celebrated for the strength of its wines, large quantities of which are exported

ported to Britain, and on this account all red wines either from Spain or Portugal are denominated *port wines*. After the earthquake at Lisbon in the year 1755, the trade of this city increased rapidly, before which memorable period its population did not exceed 20,000; but it is now computed at upwards of 40,000. Oporto is situated on the declivity of a mountain, near the river Douero, which forms an excellent and commodious harbour; and is about 147 miles north by east of Lisbon. W. Long. 8. 21. N. Lat. 41. 10.

OPOSSUM, in *Zoology*, a species of didelphis. See DIDELPHIS.

OPOUN, one of the Navigators Islands, of which there are ten in number, first discovered by Bougainville, and so called by him, because the inhabitants do not pass from one village to another but in canoes. This and the other islands lie in 14° south latitude, and from 171° to 173° longitude west from Paris, according to Perouse. Here the sugar cane is to be met with growing spontaneously; but it is said to contain less of the saccharine substance than what is produced in the West Indies. The men are possessed of uncommon strength, and tatow their bodies in such a manner, that, although almost naked, they have the appearance at a little distance of being clothed. Ferocity and treachery are characteristic marks of this people, of which the unfortunate Perouse had but too soon a melancholy proof, 11 out of 60 of his crew having been murdered by them, although received at first with an air of good humour. This ought to serve as a caution to future navigators, not to place implicit confidence in the apparent kindness of these savages, which is frequently the dismal prelude of ruin and destruction. Among these fell the celebrated naturalist Lamanon; see LAMANON.

OPPENHEIM, a town of Germany, in the lower palatinate of the Rhine, and capital of a bailiwick of the same name; seated on the declivity of a hill near the Rhine. E. Long. 8. 20. N. Lat. 49. 48.

OPPIANUS, a poet and grammarian of Anazarba in Cilicia, in the second century. He composed a poem of hunting, and another of fishing, for which Antoninus Caracalla gave him as many golden crowns as there were verses in his poems; they were hence called *Oppian's golden verses*. He died in the 30th year of his age.

OPPILATION, in *Medicine*, the act of obstructing or stopping up the passage of the body, by redundant or peccant humours. This word is used chiefly for obstructions in the lower belly.

OPTATIVE MOOD, in *Grammar*, that which serves to express an ardent desire or wish for something.

In most languages, except the Greek, the optative is only expressed by prefixing to the subjunctive an adverb of wishing; as *utinam*, in Latin: *plut à Dieu*, in French; and *would to God*, in English.

OPTIC ANGLE, the angle which the optic axes of both eyes make with one another, as they tend to meet at some distance before the eyes.

OPTIC Axis, the axis of the eye, or a line going through the middle of the pupil and the centre of the eye.

OPTICS.

History.

1 Definition. OPTICS, from ὀπτομαι, *to see*, is that science which considers the nature, the composition, and the motion of light;—the changes which it suffers from the action of bodies;—the phenomena of vision, and the instruments in which light is the chief agent.

HISTORY.

SECT. I. *Discoveries concerning the Refraction of Light.*

2 Refraction known to the ancients;

THOUGH the ancients made few optical experiments, they nevertheless knew, that when light passed through media of different densities, it did not move in a straight line, but was bent or *refracted* out of its original direction. This was probably suggested to them by the appearance of a straight rod partly immersed in water; and accordingly we find many questions concerning this and other optical appearances in the works of Aristotle. Archimedes is said to have written a treatise on the appearance of a ring or circle under water, and therefore could not have been ignorant of the common phenomena of refraction. The ancients, however, were not only acquainted with these more ordinary appearances, but also with the production of colours by refraction. Seneca says, that if the light of the sun shines through an angular piece of glass, it will show all the colours of the rainbow. These colours, he says, are false, such as are seen in a pigeon's neck when it changes its position; and of the same nature, he says, is a speculum, which, without having any colour of its own, assumes that of any other body. It appears, also, that the ancients were not ignorant of the magnifying power of glass globes filled with water, though they do not seem to have been acquainted with its cause; and the ancient engravers are supposed to have used a glass globe filled with water to magnify their figures. This indeed seems evident, from their lenticular and spherical gems of rock crystal which are still preserved, the effect of which, in magnifying at least, could scarcely have escaped the notice of those who had often occasion to handle them; if indeed, in the spherical or lenticular form, they were not solely intended for the purposes of burning. One of these, of the spherical kind, of about an inch and a half diameter, is preserved among the fossils presented by Dr Woodward to the university of Cambridge.

3 and the magnifying power of glass globes.

The first treatise of any consequence written on the subject of optics, was by the celebrated Ptolemy. The treatise is now lost; but from the accounts of others, we find that he treated of astronomical refractions. The first astronomers were not aware that the intervals between stars appear less near the horizon than near the meridian; but it is evident that Ptolemy was aware of this circumstance, by the caution which he gives to allow something

4 Refraction first treated scientifically by Ptolemy.

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something for it, upon every recourse to ancient observations.

5 His hypothesis concerning the horizontal sun and moon.

Ptolemy also advances a very sensible hypothesis to account for the greater apparent size of the sun and moon when seen near the horizon. The mind, he says, judges of the size of objects by means of a preconceived idea of their distance from us: and this distance is fancied to be greater when a number of objects intervene; which is the case when we see the heavenly bodies near the horizon. In his Almagest, however, he ascribes this appearance to a refraction of the rays by vapours, which actually enlarge the angle subtended by the luminaries.

6 Discoveries of Alhazen.

The nature of refraction was afterwards considered by Alhazen an Arabian writer; insomuch that, having made experiments upon it at the common surface between air and water, air and glass, water and glass; and, being prepossessed with the ancient opinion of crystalline orbs in the regions above the atmosphere, he even suspected a refraction there also, and fancied he could prove it by astronomical observations. Hence this author concludes, that refraction increases the altitudes of all objects in the heavens; and he first advanced, that the stars are sometimes seen above the horizon by means of refraction, when they are really below it. This observation was confirmed by Vitellio, B. Waltherus, and by the excellent observations of Tycho Brahe. Alhazen observed, that refraction contracts the vertical diameters and distances of the heavenly bodies, and that it is the cause of the twinkling of the stars. But we do not find that either he, or his follower Vitellio, subjected it to mensuration. Indeed it is too small to be determined except by very accurate instruments, and therefore we hear little more of it till about the year 1500, when great attention was paid to the subject by Bernard Walther, Mæstlin, and Tycho Brahe.

Alhazen supposed that the refraction of the atmosphere did not depend upon the vapours, but on the different transparency; by which, as Montucla conjectures, he meant the density of the gross air contiguous to the earth, and the ether or subtile air that lies beyond it. We judge of distance, he says, by comparing the angle under which objects appear, with their supposed distance; so that if these angles be nearly equal, and the distance of one object be conceived greater than that of the other, it will be imagined to be larger. He also observes, that the sky near the horizon is always imagined to be farther from us than any other part of the concave surface. Roger Bacon ascribes this account of the horizontal moon to Ptolemy; and as such it is examined, and objected to by B. Porta.

In the writings of Roger Bacon, we find the first distinct account of the magnifying power of glasses; and it is not improbable, that what he wrote upon this subject gave rise to the useful invention of spectacles. He says, that if an object be applied close to the base of the larger segment of a sphere of glass, it will appear magnified. He also treats of the appearance of an object through a globe, and says that he was the first who observed the refraction of rays into it.

7 Of Vitellio. 1270.

Vitellio, a native of Poland, published a treatise of optics, containing all that was valuable in Alhazen. He observes, that light is always lost by refraction; but he does not pretend to estimate the quantity of this loss. He reduced into a table the result of his experiments on the refractive powers of air, water, and glass, corresponding to different angles of incidence. In his account of the horizontal moon he agrees exactly with Alhazen. He ascribes the twinkling of the stars to the motion of the air in which the light is refracted; and to illustrate this hypothesis, he observes, that they twinkle still more when viewed in water put in motion. He also shows, that refraction is necessary as well as reflection, to form the rainbow; because the body which the rays fall upon is a transparent substance, at the surface of which one part of the light is always reflected and another refracted. But he seems to consider refraction as serving only to condense the light, thereby enabling it to make a stronger impression upon the eye. This writer also makes many attempts to ascertain the law of refraction. He likewise considers the foci of glass spheres, and the apparent size of objects seen through them: though upon these subjects his observations are inaccurate. It is sufficient indeed to show the state of knowledge, at that time, to observe, that both Vitellio, and his master Alhazen, account for objects appearing larger when seen under water, by the circular figure of its surface; since, being fluid, it conforms to the figure of the earth.

8 Of Roger Bacon.

Contemporary with Vitellio was Roger Bacon, a man of extensive genius, who wrote upon almost every branch of science; yet in optics he does not seem to have made any considerable advances. Even some of the most absurd of the opinions of the ancients have had the sanction of his authority. He believed that visual rays proceed from the eye; because every thing in nature is qualified to discharge its proper functions by its own powers, in the same manner as the sun and other celestial bodies. In his *Specula Mathematica*, he added some observations of little importance on the refraction of the light of the stars; the apparent size of objects; the enlargement of the sun and moon in the horizon. In his *Opus Majus* he demonstrates, what Alhazen had done before, that if a transparent body interposed between the eye and an object, be convex towards the eye, the object will appear magnified.

9 Of Maurolycus. 1575.

From this time, to that of the revival of learning in Europe, we have no treatise on optics. One of the first who distinguished himself in this way was Maurolycus, teacher of mathematics at Messina. In two works, entitled *Theoremata Lucis et Umbræ*, and *Diaphanorum Partes*, &c. he demonstrates that the crystalline humour of the eye is a lens that collects the rays of light issuing from the object, and throws them upon the retina, where is the focus of each pencil. From this principle he discovered the reason why some people were short-sighted and others long-sighted; and why the former are relieved by concave, and the others by convex, glasses.

10 Discoveries of B. Porta. Born 1445. Died 1515.

While Maurolycus made such advances towards the discovery of the nature of vision, Baptista Porta of Naples invented the *camera obscura*, which throws still more light on the same subject. His house was resorted to by all the ingenious persons at Naples, whom he formed into *an academy of secrets*; each member being obliged to contribute something useful and not generally known. By this means he was furnished with materials for his *Magia Naturalis*, which contains his account of the *camera obscura*, and which was published, as he informs us, when he was not quite 15 years old. He also gave

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gave the first hint of the magic lantern; which Kircher afterwards improved. His experiments with the *camera obscura* convinced him, that vision, as Aristotle supposed, is performed by the intromission of something into the eye, and not by visual rays proceeding from the eye, as had been formerly imagined by Empedocles; and he was the first who fully satisfied himself and others upon this subject. The resemblance indeed between experiments with the *camera obscura* and the manner in which vision is performed in the eye, was too striking to escape the observation of a less ingenious person. But when he says that the eye is a *camera obscura*, and the pupil the hole in the window shutter, he was so far mistaken as to suppose that it was the crystalline humour that corresponds to the wall which receives the images; nor was it discovered till the year 1604, that this office is performed by the retina. He makes a variety of just observations on vision; and explains several cases in which we imagine things to be without the eye, when the appearances are occasioned by some affection of the organ itself, or some motion within it. He remarks also, that, in certain circumstances, vision will be assisted by convex or concave glasses; and he seems also to have made some small advances towards the discovery of telescopes. He observes, that a round and flat surface plunged into water, will appear hollow as well as magnified to an eye above it; and he explains by a figure the manner in which this effect is produced.

11 The law of refraction discovered. 1637.

The great problem concerning the measure of refractions was still unsolved. Alhazen and Vitellio, indeed, had attempted it; but failed, by trying to measure the angle instead of its sine. At last it was discovered by Snellius, professor of mathematics at Leyden. This philosopher, however, did not perfectly understand his own discovery, nor did he live to publish any account of it. It was afterwards explained by Professor Hortensius before it appeared in the writings of Descartes, who published it under a different form, without making any acknowledgement of his obligations to Snellius, whose papers Huygens assures us, were seen by Descartes. Before this time Kepler had published a New Table of Angles of Refraction, determined by his own experiments, for every degree of incidence. Kircher had done the same, and attempted a theory of refraction, on principles, which, if conducted with precision, would have led him to the law discovered by Snellius.

12 Opinions of Descartes and Leibnitz on this subject.

Descartes undertook to explain the cause of refraction by the resolution of forces. Hence he was obliged to suppose that light passes with more ease through a dense medium, than through a rare one. The truth of this explanation was first questioned by M. Fermat, who asserted, contrary to the opinion of Descartes, that light suffers more resistance in water than air, and more in glass than in water; and maintained, that the resistance of different media with respect to light is in proportion to their densities. M. Leibnitz adopted the same general idea, upon the principle that nature accomplishes her ends by the shortest methods, and that light therefore ought to pass from one point to another, either by the shortest road, or that in which the least time is required.

At a meeting of the Royal Society, Aug. 31. 1664, it was found, with a new instrument prepared for that purpose, that the angle of incidence being 40 degrees, that of refraction is 30. About this time also we find the first mention of media not refracting the light in an exact proportion to their densities. For Mr Boyle, in a letter to Mr Oldenburgh, dated Nov. 3. 1664, observes, that in spirit of wine, the proportion of the sines of the angles of incidence to the sines of the angles of refraction was nearly the same as 4 to 3; and that, as spirit of wine occasions a greater refraction than common water, so oil of turpentine, which is lighter than spirit of wine, produces not only a greater refraction than common water, but a much greater than salt water. And at a meeting held November 9. the same year, Dr Hooke mentioned, that pure and clear salad oil produced a much greater refraction than any liquor which he had tried; the angle of refraction that answered to an angle of incidence of 30° being no less than 40° 30′, and the angle of refraction that answered to an angle of incidence of 20° being 29° 47′.—M. de la Hire also made several experiments to ascertain the refractive power of oil, and found the sine of the angle of incidence to that of refraction as 60 to 42; which, he observes, is a little nearer to that of glass than to that of water, though oil is much lighter than water, and glass much heavier.

13 Discoveries concerning the refraction of different substances.

The members of the Royal Society finding that the refraction of salt water exceeded that of fresh, pursued the experiment farther with aqueous solutions of vitriol, saltpetre, and alum. They found the refraction of the solution of vitriol and saltpetre a little more, but that of alum a little less, than common water.

Dr Hooke made an experiment before the Royal Society, Feb. 11. 1663, which clearly proves that ice refracts the light less than water. M. de la Hire also took a good deal of pains to determine whether the refractive power of ice and water were the same; and he found, as Dr Hooke had done before, that ice refracts less than water.

By a most accurate experiment made in 1698, in which a ray of light was transmitted through a Torricellian vacuum, Mr Lowthorp found, that the refractive power of air is to that of water as 36 to 34.400. He observes, that the refractive power of bodies is not proportioned to the density, at least not to the specific gravity, of the refracting medium. For the refractive power of glass to that of water is as 55 to 34, whereas its specific gravity is as 87 to 34; that is, the squares of their refractive powers are very nearly as their respective gravities. And there are some fluids, which, though they are lighter than water, yet have a greater power of refraction. Thus the refractive power of spirit of wine, according to Dr Hooke's experiment, is to that of water as 36 to 33, and its gravity reciprocally as 33 to 36, or $36\frac{1}{7}$. But the refractive powers of air and water seem to observe the simple direct proportion of their gravities.

The Royal Academy of Sciences at Paris endeavoured to repeat this experiment in 1700; but they did not succeed.—For, as they said, beams of light passed through the vacuum without suffering any refraction. The Royal Society being informed of this, ordered Mr Hawksbee to make an instrument for the purpose, under the direction of Dr Halley, for the purpose of repeating the experiment. It consisted of a strong brass prism, two sides of which had sockets to receive two plane glasses,

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glasses, whereby the air in the prism might either be exhausted or condensed. The prism had also a mercurial gage fixed to it, to discover the density of the contained air; and turned upon its axis, in order to make the refractions equal on each side when it was fixed to the end of a telescope. The refracting angle was near 64°; and the length of the telescope, having a fine hair in its focus, was about 10 feet. The event of this accurate experiment was as follows:—Having chosen a proper object, whose distance was 2588 feet, June 15. O. S. 1708, in the morning, the barometer being then at $29.7\frac{1}{7}$, and the thermometer at 60, they first exhausted the prism, and then applying it to the telescope, the horizontal hair in the focus covered a mark on the object distinctly seen through the vacuum, the two glasses being equally inclined to the visual ray. Then admitting the air into the prism, the object was seen to rise above the hair gradually as the air entered, and when the prism was full, the hair was observed to hide a mark $10\frac{1}{4}$ inches below the former mark.

After this they applied the condensing engine to the prism; and having forced in another atmosphere, so that the density of the included air was double to that of the outward, they again placed it before the telescope, and, letting out the air, the object, which before seemed to rise, appeared gradually to descend, and the hair at length rested on an object higher than before by the same interval of $10\frac{1}{4}$ inches They then forced in another atmosphere; and upon discharging the condensed air, the object was seen near 21 inches lower than before.

Now the radius in this case being 2588 feet, $10\frac{1}{4}$ inches will subtend an angle of 1′ 8″, and the angle of incidence of the visual ray being 32 degrees (because the angle of the glass planes was 64°), it follows from the known laws of refraction, that as the sine of 39° is to that of 31° 59′ 26″, differing from 32° by 34″ the half of 1′ 8″; so is the sine of any other angle of incidence, to the sine of its angle of refraction; and so is radius, or 1000000, to 999736; which, therefore, is the proportion between the sine of incidence *in vacuo* and the sine of refraction from thence into common air.

14
Refractive power of the air determined.

It appears, by these experiments, that the refractive power of the air is proportional to its density. And since the density of the atmosphere is as its weight directly, and its temperature inversely, the ratio of its density, at any given time, may be had by comparing the heights of the barometer and thermometer; and thence he concludes that this will also be the ratio of the refraction of the air. But Dr Smith observes, that before we can depend upon the accuracy of this conclusion, we ought to examine whether heat and cold alone may not alter the refractive power of air, while its density continues the same.

The French academicians, being informed of the result of the above-mentioned experiment, employed M. De l'Isle the younger to repeat the former experiment with more care: He presently found, that the operators had never made any vacuum at all, there being chinks in their instrument, through which the air had insinuated itself. He therefore annexed a gage to his instrument, by which means he was sure of his vacuum; and then the result of the experiment was the same with that of the Royal Society. The refraction was always proportional to the density of the air, excepting when the mercury was very low, and consequently the air very rare; in which case the whole quantity being very small, he could not perceive much difference in them. Comparing, however, the refractive power of the atmosphere, observed at Paris, with the result of his experiment, he found, that the best vacuum he could make was far short of that of the regions above the atmosphere.

Dr Hooke first suggested the idea of making allowance for the effect of the refraction of light, in passing from the rarer to the denser regions of the atmosphere, in the computed height of mountains. To this he ascribes the different opinions of authors concerning the height of several very high hills. He could not account for the appearance of very high mountains, at so great a distance as that at which they are actually seen, but upon the supposition of the curvature of the visual ray, that is made by its passing obliquely through a medium of such different density, from the top of them to the eye, very far distant in the horizon. All calculations of the height of mountains that are made upon the supposition that the rays of light come from the tops of them, to our eyes, in straight lines, he considers very erroneous.

Dr Hooke ascribes the twinkling of the stars to the irregular and unequal refraction of the rays of light, which is also the reason why the limbs of the sun, moon, and planets, appear to wave or dance. That there is such an unequal distribution of the atmosphere, he says, will be evident by looking upon distant objects, over a piece of hot glass, which cannot be supposed to throw out any kind of exhalation from itself, as well as through ascending steams of water.

About this time Grimaldi first observed that the coloured image of the sun refracted through a prism is always oblong, and that colours proceed from refraction. —The way in which he first discovered this was by Vitellio's experiment already mentioned, in which a piece of white paper placed at the bottom of a glass vessel filled with water, and exposed to the light of the sun, appears coloured. However, he observed, that in case the two surfaces of the refracted medium were exactly parallel to each other, no colours were produced. But of the true cause of those colours, he had not the least suspicion. This discovery was reserved for Sir Isaac Newton. Having procured a triangular glass prism to satisfy himself concerning the phenomena of colours; he was surprised at the oblong figure of the coloured spectrum, and the great disproportion betwixt its length and breadth; the former being about five times the measure of the latter. After various conjectures respecting the causes of these appearances, he suspected that the colours might arise from the light being dilated by some unevenness in the glass, or some other accidental irregularity; and to try this, he took another prism like the former, and placed in such a manner, that the light, passing through them both, might be refracted in opposite directions, and thus be returned by the latter into the same course from which it had been diverted by the former. In this manner he thought that the regular effects of the first prism would be augmented by the multiplicity of refractions. The event was, that the light, diffused by the first prism into an oblong form, was by by the second reduced into a circular one, with as much regularity as if it had not passed through either of them. He then hit upon what he calls the *experimentum crucis*, and found that light is not similar, or homogeneous; but that it consists of rays, some of which are more refrangible than others: so that, without any difference in their incidence on the same medium, some of them shall be more refracted than others; and therefore, that, according to their particular degrees of refrangibility, they will be transmitted through the prism to different parts of the opposite wall.

Since it appears from these experiments that different rays of light have different degrees of refrangibility, it follows, that the rules laid down by preceding philosophers concerning the refractive power of water, glass, &c. must be limited to the mean rays of the spectrum. Sir Isaac, however, proves, both geometrically and by experiment, that the sine of the incidence of every kind of light, considered apart, is to its sine of refraction in a given ratio.

17 Mr Dollond's discovery of the method of correcting the errors of refracting telescopes.

The most important discovery concerning refraction since the time of Sir Isaac Newton is that of Mr Dollond, who found out a method of remedying the defects of refracting telescopes arising from the different refrangibility of light. Sir Isaac Newton imagined that the different rays were refracted in the same proportion by every medium, so that the refrangibility of the extreme rays might be determined if that of the mean ones were given. From this it followed, as Mr Dollond observes, that equal and contrary refractions must not only destroy each other, but that the divergency of the colours from one refraction would likewise be corrected by the other, and that there could be no possibility of producing any such thing as refraction without colour. Hence it was natural to infer, that all object glasses of telescopes must be equally affected by the different refrangibility of light, in proportion to their apertures, of whatever materials they may be formed.

For this reason, philosophers despaired of bringing refracting telescopes to perfection. They therefore applied themselves chiefly to the improvement of the reflecting telescope; till 1747, when M. Euler, improving upon a hint of Sir Isaac Newton's, proposed to make object glasses of water and glass; hoping, that by their difference of refractive powers, the refractions would balance one another, and thereby prevent the dispersion of the rays that is occasioned by their difference of refrangibility. This memoir of M. Euler excited the attention of Mr Dollond. He went over all M. Euler's calculations, substituting for his hypothetical laws of refraction those which had been ascertained by Newton; and found, that it followed from Euler's own principles, that there could be no union of the foci of all kinds of colours, but in a lens infinitely large.

Euler did not mean to controvert the experiments of Newton: but asserted, that, if they were admitted in all their extent, it would be impossible to correct the difference of refrangibility occasioned by the transmission of the rays from one medium into another of different density; a correction which he thought was very possible, since he supposed it to be effected in the eye, which he considered as an achromatic instrument. To this reasoning Mr Dollond made no reply, but by appealing to the experiments of Newton, and the circumspection with which it was known that he conducted all his inquiries.

This paper of Euler's was particularly noticed by M. Klingenstierna of Sweden, who found that, from Newton's own principles, the result of his 8th experiment could not answer his description of it. Newton found, that when light passes out of air through several media, and thence goes out again into air, whether the refracting surfaces be parallel or inclined to one another, this light, as often as by contrary refractions it is so corrected as to emerge in lines parallel to those in which it was incident, continues ever after to be white; but if the emergent rays be inclined to the incident, the whiteness of the emerging light will, by degrees, become tinged at its edges with colours. This he tried by refracting light with prisms of glass, placed within a prismatic vessel of water.

By theorems deduced from this experiment he infers, that the refractions of the rays of *every* sort, made out of any medium into air, are known by having the refraction of the rays of *any one* sort; and also that the refraction out of one medium into another is found as often as we have the refractions out of them both into any third medium.

On the contrary, the Swedish philosopher observes, that, in this experiment, the rays of light, after passing through the water and the glass, though they come out parallel to the incident rays, will be coloured; but that the smaller the glass prism is, the nearer will the result of it approach to Newton's description.

This paper of M. Klingenstierna being communicated to Dollond, made him entertain doubts concerning Newton's report, and induced him to have recourse to experiment.

He therefore cemented together two plates of glass at their edges, so as to form a prismatic vessel, when stopped at the ends; and the edge being turned downwards, he placed in it a glass prism, with one of its edges upwards, and filled up the vacancy with clear water; so that the refraction of the prism was contrary to that of the water, in order that a ray of light, transmitted through both these refracting media, might be affected by the difference only between the two refractions. As he found the water to refract more or less than the glass prism, he diminished or increased the angle between the glass plates, till he found the two contrary refractions to be equal; which he discovered by viewing an object through this double prism. For when it appeared neither raised or depressed, he was satisfied that the refractions were equal, and that the emergent and incident rays were parallel.

But according to the prevailing opinion, the object should have appeared of its natural colour; for if the difference of refrangibility had been equal in the two equal refractions, they would have rectified each other. This experiment, therefore, fully proved the fallacy of the received opinion, by showing the divergency of the light by the glass prism to be almost double of that by the water; for the image of the object was as much infected with the prismatic colours, as if it had been seen through a glass wedge only, whose refracting angle was near 30 degrees.

Mr Dollond was convinced that if the refracting angle of the water vessel could have admitted of a sufficient increase, the divergency of the coloured rays would have been greatly diminished, or entirely rectified; and that there would have been a very great refraction without

out colour; but the inconvenience of so large an angle as that of the prismatic vessel must have been, to bring the light to an equal divergency with that of the glass prism whose angle was about 60 degrees, made it necessary to try some experiments of the same kind with smaller angles.

He, therefore, got a wedge of plate glass, the angle of which was only nine degrees; and using it in the same circumstances, he increased the angle of the water wedge, in which it was placed, till the divergency of the light by the water was equal to that by the glass; that is, till the image of the object, though considerably refracted by the excess of the refraction of the water, appeared quite free from any colours proceeding from the different refrangibility of the light; and as near as he could then measure, the refraction by the water was about $\frac{1}{4}$ of that by the glass.

As these experiments proved, that different substances caused the light to diverge very differently in proportion to their general refractive power, Mr Dollond began to suspect that such a variety might possibly be found in different kinds of glass.

His next object, therefore, was to grind wedges of different kinds of glass, and apply them together; so that the refractions might be made in contrary directions, in order to discover whether the refraction and the divergency of the colours would vanish together.

From these experiments, which were not made till 1757, he discovered a difference far beyond his hopes in the refractive qualities of different kinds of glass, with respect to the divergency of colours. The yellow or straw coloured kind, commonly called *Venice glass*, and the *English crown glass*, proved to be nearly alike in that respect; though, in general, the crown glass seemed to make light diverge less than the other. The common English plate glass made the light diverge more; and the white crystal, or English flint glass, most of all.

He then examined the particular qualities of every kind of glass that he could obtain, to fix upon two kinds in which the difference of their dispersive powers should be the greatest; and he soon found these to be the crown glass and the white flint glass. He therefore ground one wedge of white flint, of about 25 degrees; and another of crown glass, of about 29 degrees; which refracted very nearly alike, but their power of making the colours diverge was very different. He then ground several others of crown glass to different angles, till he got one which was equal, with respect to the divergency of the light, to that in the white flint glass; for when they were put together so as to refract in contrary directions, the refracted light was entirely free from colours. Then measuring the refraction of each wedge with these different angles, he found that of the white glass to be to that of the crown glass nearly as two to three: so that any two wedges made in this proportion, and applied together, that they might refract in a contrary direction, would transmit the light without any dispersion of the rays. He found also, that the sine of incidence in crown glass is to that of its general refraction as 1 to 1.53, and in flint glass as 1 to 1.583.

In order to apply these discoveries to the construction of telescopes, Mr Dollond considered, that in order to make two spherical glasses that should refract the light in contrary directions, the one must be concave and the other convex; and as the rays are to converge to a real focus, the excess of refraction must be in the convex lens. Also, as the convex glass is to refract the most, it appeared from his experiments, that it must be made of crown glass, and the concave of white flint glass. Farther, As the refractions of spherical glasses are in the inverse ratio of their focal distances, it follows, that the focal distances of the two glasses shall be inversely as the ratios of the refractions of the wedges; for being thus proportioned, every ray of light that passes through this combined glass, at whatever distance it may pass from its axis, will constantly be refracted, by the difference between two contrary refractions, in the proportion required; and therefore the different refrangibility of the light will be entirely removed.

The difficulties which occurred in the application of this reasoning to practice, arose from the following circumstances. In the first place, The focal distances, as well as the particular surfaces, must be very nicely proportioned to the densities or refracting powers of the glasses, which are very apt to vary in the same sort of glass made at different times. Secondly, The centres of the two glasses must be placed truly in the common axis of the telescope, otherwise the desired effect will be in a great measure destroyed. And, thirdly, The difficulty of forming the four surfaces of the lenses exactly spherical. At length, however, after numerous trials, he was able to construct refracting telescopes, with such apertures and magnifying powers, under limited lengths, as far exceeded any thing that had been produced before, representing objects with great distinctness, and in their natural colours.

As Mr Dollond did not explain the method by which he determined the curvatures of his lenses, the celebrated M. Clairaut, who had begun to investigate this subject, endeavoured to reduce it to a complete theory, from which rules might be deduced, for the benefit of the practical optician.

With this view, therefore, he endeavoured to ascertain the refractive power of different kinds of glass, and also their property of dispersing the rays of light. For this purpose he made use of two prisms, as Mr Dollond had done: but, instead of looking through them, he placed them in a dark room; and when the transmitted image of the sun was perfectly white, he concluded that the different refrangibility of the rays was corrected.

In order to ascertain more easily the true angles that prisms ought to have in order to destroy the effect of the difference of refrangibility, he constructed a prism which had one of its surfaces cylindrical, with several degrees of amplitude. By this means, without changing his prisms, he had the choice of an infinity of angles; among which, by examining the point of the curve surface, which, receiving the solar ray, gave a white image, he could easily find the true one. He also ascertained the proportion in which different kinds of glass separated the rays of light, by measuring, with proper precautions, the oblong image of the sun made by transmitting through them a beam of light.

In these experiments M. Clairaut was assisted by M. de Tournieres, and the results agreed with Mr Dollond's in general; but whereas Mr Dollond had made the dispersion of the rays in glass and in water to be as five

five to four (acknowledging, however, that he did not pretend to do it with exactness), these gentlemen, who took more pains, found it to be as three to two. For the theorems and problems deduced by M. Clairaut from these new principles of optics, with a view to the perfection of telescopes, we must refer the reader to *Mem. Acad. Par.* 1756, 1757.

The subject of achromatic telescopes was also investigated by the illustrious D'Alembert. This excellent mathematician proposed a variety of new constructions, the advantages and disadvantages of which he distinctly notes; at the same time that he points out several methods of correcting the errors to which these telescopes are liable: as by placing the object glasses, in some cases, at a small distance from one another, and sometimes by using eye glasses of different refractive powers; which is an expedient that does not seem to have occurred to any person before him. He even shows, that telescopes may be made to advantage, consisting of only one object glass, and an eye glass of a different refractive power. Some of his constructions have two or more eye glasses of different kinds of glass. This subject he considered at large in one of the volumes of his *Opuscules Mathematiques*. We have also three memoirs of M. D'Alembert upon this subject, among those of the French Academy; in the years 1764, 1765, and 1767.

The investigations of Clairaut and D'Alembert do not seem to have assisted the exertions of foreign artists. The telescopes made in England, according to no exact rule, as foreigners supposed, were greatly superior to any that could be made elsewhere, though under the immediate direction of those able calculators.

M. Euler who first gave occasion to this inquiry, having persuaded himself, both by reasoning and calculation, that Mr Dollond had discovered no new principle in optics, and yet not being able to controvert Mr Short's testimony in favour of the achromatic telescopes, concluded that this extraordinary effect was partly owing to the crown glass not transmitting all the red light, which would have otherwise come to a different focus, and have distorted the image; but principally to his giving a just curvature to his glass, which he did not doubt would have produced the same effect if the lenses had all been made of the same kind of glass. At another time he imagined that the goodness of Mr Dollond's telescopes might be owing to the eye glass. If my theory, says he, be true, this disagreeable consequence follows, that Mr Dollond's object glasses cannot be exempt from the dispersion of colours: yet a regard to so respectable a testimony embarrasses me extremely, it being as difficult to question such express authority, as to abandon a theory which appears to me well founded, and to embrace an opinion which is as contrary to all the established laws of nature as it is strange and seemingly absurd. He even appeals to experiments made in a darkened room; in which he says, he is confident that Mr Dollond's object-glasses would appear to have the same defects to which others are subject.

Not doubting, however, but that Mr Dollond had made some improvement in the construction of telescopes, by the combination of glasses, he abandoned his former project, in which he had recourse to different media, and confined his attention to the correction of the errors which arise from the curvature of lenses. But while he was proceeding, as he imagined, upon the true principles of optics, he could not help expressing his surprise that Mr Dollond should have been led to so important a discovery by reasoning in a manner quite contrary to the nature of things. At length, however, M. Euler was convinced of the reality and importance of Mr Dollond's discoveries; and frankly acknowledges, that perhaps he should never have been brought to assent to it, had he not been assured by his friend M. Clairaut that the experiments of the English optician might be depended upon. The experiments of M. Zeiher, however, gave him the most complete satisfaction with respect to this subject. This gentleman demonstrated, that it is the lead in the composition of glass which produces the variation in its dispersive power; and, by increasing the quantity of lead in the mixture, he produced a kind of glass, which occasioned a much greater separation of the extreme rays than the flint glass which Mr Dollond had made use of.

From these new principles M. Euler deduces theorems concerning the combination of the lenses, and, in a manner similar to M. Clairaut and D'Alembert, points out methods of constructing achromatic telescopes. 18

Different compositions of glass for the purpose of correcting the imperfection of telescopes.

While he was employed upon this subject, he informs us, that he received a letter from M. Zeiher, dated Petersburgh, 30th of January 1764, in which he gives him a particular account of the success of his experiments on the composition of glass; and that, having mixed minium and sand in different proportions, the result of the mean refraction and the dispersion of the rays varied according to the following table.

	Proportion of minium to flint.	Ratio of the mean refraction from air into glass.	Dispersion of the rays in comparison of crown glass.
I.	— 3 : 1	2028 : 1000	4800 : 1000
II.	— 2 : 1	1830 : 1000	3550 : 1000
III.	— 1 : 1	1787 : 1000	3259 : 1000
IV.	— $\frac{3}{4}$: 1	1732 : 1000	2207 : 1000
V.	— $\frac{1}{2}$: 1	1724 : 1000	1800 : 1000
VI.	— $\frac{1}{4}$: 1	1664 : 1000	1354 : 1000

From this table it is evident, that a greater quantity of lead not only produces a greater dispersion of the rays, but also increases the mean refraction. The first of these kinds of glass, which contains three times as much minium as flint, will appear very extraordinary; since, hitherto, no transparent substance has been known, whose refractive power exceeded the ratio of two to one, and since the dispersion occasioned by this glass is almost five times as great as that of crown glass, which could scarcely be believed by those who entertained any doubt concerning the same property in flint glass, the effect of which is three times as great as crown glass.

Here, however, M. Euler announces to us another discovery of M. Zeiher, no less surprising than the former, and which disconcerted all his schemes for reconciling the above-mentioned phenomena. As the six kinds of glass mentioned in the preceding table were composed of nothing but minium and flint, M. Zeiher happened to think of mixing alkaline salts with them, in order to give the glass a consistence more proper for dioptric uses: This mixture, however, greatly diminished the mean refraction, almost without making any change in the dispersion. After many trials, he is said to have obtained a kind of glass, which occasioned three times as great a dispersion of the rays as the common glass, at the same time that the mean refraction was only as 1.61 to 1.; though we have not heard that this kind of glass was ever used in the construction of telescopes.

Mr Dollond was not the only optician who had the merit of discovering the achromatic telescope, as this instrument appears to have been constructed by a private gentleman—Mr Chester More Hall. He observed that prisms of flint glass gave larger spectra than prisms of water, when the mean refraction was the same in both. He tried prisms of other glass, and found similar differences; and he applied this discovery to the same purposes as Mr Dollond. These facts came out in a process raised at the instance of Watkins optician, as also in a publication of Mr Ramsden. There is, however, no evidence that Dollond stole the idea from Mr Hall, or that they had not both claims to the discovery.

The best refracting telescopes, constructed on the principles of Mr Dollond, are still defective, on account of that colour which, by the aberration of the rays, they give to objects viewed through them, unless the object glass be of small diameter. This defect philosophers have endeavoured to remove by various contrivances, and Boscovich has, in his attempts for this purpose, displayed much ingenuity; but the philosopher whose exertions have been crowned with most success, and who has perhaps made the most important discovery in this science, is Dr Robert Blair professor of practical astronomy in the college of Edinburgh.

19 Discovery of Dr Robert Blair for this purpose.

By a judicious set of experiments, he has proved, that the quality of dispersing the rays in a greater degree than crown glass, is not confined to a few media, but is possessed by a great variety of fluids, and by some of these in a most extraordinary degree. He has shown, that though the greater refrangibility of the violet rays than of the red rays, when light passes from any medium whatever into a vacuum, may be considered as a law of nature; yet in the passage of light from one medium into another, it depends entirely on the qualities of the media which of these rays shall be the most refrangible, or whether there shall be any difference in their refrangibility. In order to correct the aberration arising from difference of refrangibility among the rays of light, he instituted a set of experiments, by which he detected a very singular and important quality in the muriatic acid. In all the dispersive media hitherto examined, the green rays, which are the mean refrangible in crown glass, were found among the less refrangible; but in the muriatic acid, these same rays were found to make a part of the more refrangible. This discovery led to complete success in removing the great defect of optical instruments, viz. that dissipation or aberration of the rays which arises from their unequal refrangibility, and has hitherto rendered it impossible to converge all of them to one point either by single or opposite refractions. A fluid, in which the particles of marine acid and metalline particles hold a due proportion, at the same time that it separates the extreme rays of the spectrum much more than crown glass, refracts all the orders of the rays in the same proportion that glass does: and hence rays of all colours, made to diverge by the refraction of the glass, may either be rendered parallel by a subsequent refraction in the confine of the glass and this fluid; or, by weakening the refractive density of the fluid, the refraction which takes place in the confine of it and glass may be rendered as regular as reflection, without the least colour whatever. The doctor has a telescope, not exceeding 15 inches in length, with a compound object glass of this kind, which equals in all respects, if it does not surpass, the best of Dollond's 42 inches long. See Phil. Trans. Edin. vol. iii.

20 Of the refraction of the atmosphere.

We shall conclude the history of the discoveries concerning refraction, with some account of the refraction of the atmosphere.—Tables of refraction have been calculated by Mr Lambert, with a view to correct inaccuracies in determining the altitudes of mountains geometrically. The observations of Mr Lambert go upon the supposition that the refractive power of the atmosphere is invariable: But as this is by no means the case, his rules must be considered as true only for the mean state of the air.

Dr Nettleton observed a remarkable variety in the refractive power of the atmosphere, which demonstrates how little we can depend upon the calculated heights of mountains, when the observations are made with an instrument, and when the refractive power of the air is to be taken into the account. Being desirous to learn, by observation, how far the mercury would descend in the barometer at any given elevation, he proposed to measure the height of some of their highest hills; but when he attempted it, he found his observation so much disturbed by refraction, that he could obtain no certain result. Having measured one hill of a considerable height, in a clear day, and observed the mercury at the bottom and at the top, he found, that about 19 feet or more were required to make the mercury fall $\frac{1}{10}$th of an inch; but afterwards, repeating the experiment, when the air was rather gross and hazy, he found the small angles so much increased by refraction as to make the hill much higher than before. He afterwards frequently made observations at his own house, by pointing a quadrant to the tops of some neighbouring hills, and observed that they would appear higher in the morning before sunrise, and also late in the evening, than at noon in a clear day, by several minutes. In one case the elevations of the same hill differed more than 30 minutes.

M. Euler considered the refractive power of the atmosphere, as affected by different degrees of heat and elasticity; in which he shows that its refractive power, to a considerable distance from the zenith, is sufficiently near the proportion of the tangent of that distance, and that the law of refraction follows the direct ratio of the difference marked by the thermometer; but when stars are in the horizon, the changes are in a ratio somewhat greater than this, more especially on account of the variation in the heat.

21 La Place resolves the problem of astronomical refraction.

As the density of the atmosphere varies with its altitude, and as the irregular curvature of the earth causes a constant change in the inclination of the strata through which any ray of light passes to the eye, the refraction cannot be obtained from the density of the atmosphere, and the angular direction of the refracted ray. By comparing astronomical with meteorological observations, however, the celebrated M. La Place has given

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given a complete solution of this very important problem.

22 Phenomena of irregular refractions.

The phenomena known by the names of *mirage*, *looming*, and *fata morgana*, have been traced to irregularities of refractions arising from accidental changes in the temperature of the atmosphere. From the rarefaction of the air near the surface of water, buildings, or the earth itself, a distant object seen through this rarefied air sometimes appears depressed instead of raised by refraction; at other times it appears both elevated and depressed, so that the object seems double, and sometimes triple, one of the images being in an inverted position. This subject is much indebted to the researches of the ingenious Dr Wollaston, who has imitated these natural phenomena by viewing objects through the rarefied air contiguous to a red-hot poker, or through a saline or saccharine solution with water and spirit of wine floating upon its surface. This branch of optics has also been well illustrated by Mr Vince and Mr Huddart.

SECT. II. *Discoveries concerning the Reflection of Light.*

23 Discoveries of the ancients.

The followers of Plato were acquainted with the equality between the angles of incidence and reflection; and it is probable that they discovered this, by observing a ray of the sun reflected from standing water, or some other polished body; or from attending to the images of objects reflected by such surfaces. If philosophers paid any attention to this phenomenon, they could not but perceive, that, if the ray fell nearly perpendicular upon such a surface, it was reflected near the perpendicular; and if it fell obliquely, it was reflected obliquely: and observations upon these angles, the most rude and imperfect, could not fail to convince them of their equality, and that the incident and reflected rays were in the same plane.

Aristotle was sensible that it is the reflection of light from the atmosphere which prevents total darkness after the sun sets, and in places where he does not shine in the day-time. He was also of opinion, that rainbows, halos, and mock suns, were occasioned by the reflection of the sunbeams in different circumstances, by which an imperfect image of his body was produced, the colour only being exhibited, and not his proper figure. The image, he says, is not single, as in a mirror; for each drop of rain is too small to reflect a visible image, but the conjunction of all the images is visible.

24 Treatise of optics by Euclid.

Without inquiring any farther into the nature of light or vision, the ancient geometers contented themselves with deducing a system of optics from two facts, the rectilineal progress of light, and the equality of the angles of incidence and reflection. The treatise of optics ascribed to Euclid is employed in determining the apparent size and figure of objects, from the angle which they subtend at the eye, and the apparent place of the image of an object reflected from a polished miror. This place he fixes at the point where the reflected ray meets a perpendicular to the mirror drawn through the object. But this work is so imperfect and inaccurate, that it does not seem to be the production of Euclid.

25 Burning glasses of the ancients.

It appears from Pliny and Lactantius, that burning glasses were known to the ancients. In one of the plays of Aristophanes, indeed, a person is introduced who proposes to destroy his adversary's papers by means of this instrument; and there is reason to believe that the Romans had a method of lighting their sacred fire by means of a concave speculum. It seems indeed to have been known A. C. 433, that there is an increase of heat in the place where the rays of light meet, after reflection from a concave mirror. The burning power of concave mirrors is noticed by the author of the work ascribed to Euclid. If we give any credit to what some ancient historians are said to have written concerning the exploits of Archimedes, we shall be induced to think that he constructed some very powerful burning mirrors; but nothing being said of other persons making use of his inventions, the whole account is very doubtful. It is allowed, however, that this eminent geometer did write a treatise on the subject of burning mirrors, which has not descended to our times.

B. Porta supposes that the burning mirrors of the ancients were parabolic and made of metal. It follows from the properties of this curve, that all the rays which fall upon it, parallel to its axis, will meet in the same point at the focus. Consequently, if the vertex of the parabola be cut off, as in fig. 1. it will make a convenient burning mirror. In some drawings of this instrument the frustum is so small, as to look like a ring. With an instrument of this kind, it is thought, that the Romans lighted their sacred fire, and that with a similar mirror Archimedes burnt the Roman fleet; using a lens, to throw the rays parallel, when they had been brought to a focus; or applying a smaller parabolic mirror for this purpose, as is represented fig. 2.

Plate CCCLXXV. Fig. 1.

Fig. 2.

26 Of seeing images in the air.

The nature of reflection was, however, very far from being understood. Even Lord Bacon, who made much greater advances in physics than his predecessors, supposed it possible to see the image reflected from a looking glass, without seeing the glass itself; and to this purpose he quotes a story of Friar Bacon, who is reported to have apparently walked in the air between two steeples, and which was thought to have been effected by reflection from glasses while he walked upon the ground.

Vitellio had endeavoured to show that it is possible, by means of a cylindrical convex speculum, to see the images of objects in the air, out of the speculum, when the objects themselves cannot be seen. But from his description of the apparatus, it will be seen that the eye was to be directed towards the speculum placed within a room, while the object and the spectator were without it. But as no such effect can be produced by a convex mirror, Vitellio must have been under some deception with respect to his experiment.

B. Porta says, that this effect may be produced by a plain mirror only; and also by the combination of a plain and a concave mirror.

Kircher also speaks of the possibility of exhibiting these pendulous images, and supposes that they are reflected from the dense air: But the most perfect and pleasing deception, depending upon the images in the air, is one of which this writer gives a particular account in his *Ars Magna Lucis et Umbræ*, p. 783. In this case the image is placed at the bottom of a hollow polished cylinder, by which means it appears like a real solid substance, suspended within the mouth of the vessel.

27 Discoveries of Kepler.

It was Kepler who first discovered, that the apparent places of objects seen by reflecting mirrors depended upon

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upon the angle which the rays of light, issuing from the extreme part of an object, make with one another after reflection.

28 Discoveries of Mr Boyle.

Mr Boyle made some curious observations concerning the reflecting powers of differently coloured substances. In order to shew that snow shines by a *borrowed* and not by a *native* light, he placed a quantity of it in a room, from which all foreign light was excluded, and found that it was completely invisible. To try whether white bodies reflect more light than others, he held a sheet of white paper in a sunbeam admitted into a darkened room; and observed that it reflected much more light than a paper of any other colour, a considerable part of the room being enlightened by it. To show that white bodies reflect the rays outwards, he adds, that common burning glasses require a long time to burn or discolour white paper; that the image of the sun was not so well defined upon white paper as upon black; that when he put ink upon the paper, the moisture would be quickly dried up, and the paper, which he could not burn before, would presently take fire;—and that by exposing his hand to the sun, with a thin black glove upon it, it would be suddenly and more considerably heated, than if he held his naked hand to the rays, or put on a glove of thin white leather.

To prove that black is the reverse of white, with respect to its property of reflecting the rays of the sun, he procured a large piece of black marble, ground into the form of a large concave speculum, and found that the image of the sun reflected from it was far from offending or dazzling his eyes, as it would have done from another speculum; and though this was large, he could not for a long time set a piece of wood on fire with it; though a far less speculum, of the same form, and of a more reflecting substance, would presently have made it flame.

To satisfy himself still farther with respect to this subject, he took a tile; and having made one half of its surface white and the other black, he exposed it to the summer sun. Having let it lie there some time, he found, that while the whitened part remained cool, the black part was very hot. He sometimes left part of the tile of its native red; and, after exposing the whole to the sun, observed that this part grew hotter than the white, but not so hot as the black part.

29 Of the infusion of lignum nephriticum.

A remarkable property of lignum nephriticum (a species of guilandina) was first observed by Kircher. Mr Boyle has described this lignum nephriticum as a whitish kind of wood, which was brought from Mexico, and which had been thought to tinge water of a green colour only; but he says that he found it to communicate all kinds of colours. If an infusion of this wood be put into a glass globe, and exposed to a strong light, it will be as colourless as pure water; but if it be carried into a place a little shaded, it will be a beautiful green. In a place still more shaded, it will incline to red; and in a very shady place, or in an opaque vessel, it will be green again.

Mr Boyle first distinctly noted the two very different colours which this remarkable tincture exhibits by transmitted and reflected light. If it be held directly between the light and the eye, it will appear tinged (excepting the very top of it, where a sky-coloured circle sometimes appears) almost of a golden colour, except the infusion be too strong; in which case it will be dark or reddish, and requires to be diluted with water. But if it be held from the light, so that the eye be between the light and the phial, it will appear of a deep lively blue colour, as will also the drops, if any lie on the outside of the glass.

When a little of this tincture was poured upon a sheet of white paper, and placed in a window where the sun shone upon it, he observed, that if he turned his back upon the sun, the shadow of any body projected upon the liquor would not be all dark, like other shadows; but that part of it would be curiously coloured, the edge of it next the body being almost of a lively golden colour, and the more remote part blue.

Observing that this tincture, if it were too deep, was not tinged in so beautiful a manner, and that the impregnating virtue of the wood did, by frequent infusion in fresh water, gradually decay, he conjectured that the tincture contained much of the essential salt of the wood; and to try whether the subtle parts, on which the colour depended, were volatile enough to be distilled, without dissolving their texture, he applied some of it to the gentle heat of a lamp furnace; but he found all that came over was as limpid and colourless as rock water, while that which remained behind was of so deep a blue, that it was only in a very strong light that it appeared of any colour.

Having sometimes brought a round long-necked phial, filled with this tincture, into a darkened room, into which a beam of the sun was admitted by a small aperture; and holding the phial sometimes near the sunbeams, and sometimes partly in them and partly out of them, changing also the position of the glass, and viewing it from several parts of the room, it exhibited a much greater variety of colours than it did in an enlightened room. Besides the usual colours, it was red in some places and green in others, and within were intermediate colours produced by the different mixtures of light and shade.

It was not only in this tincture of lignum nephriticum that Mr Boyle perceived the difference between reflected and transmitted light. He observed it even in gold, though no person explained the cause of these appearances before Sir Isaac Newton. He took a piece of leaf gold, and holding it betwixt his eye and the light, observed, that it did not appear of a golden colour, but of a greenish blue. He also observed the same change of colour by candle light; but the experiment did not succeed with a leaf of silver.

The constitution of the atmosphere and of the sea, we shall find, by more recent observations, to be similar to that of this infusion; for the blue rays, and others of a faint colour, do not penetrate so far into them as the red, and others of a stronger colour.

The first distinct account of the colours exhibited by thin plates of various substances is to be found among the observations of Mr Boyle. To show that colours may be made to appear or vanish, where there is no accession or change either of the sulphureous, the saline, or the mercurial principle of bodies, he observes, that all chemical essential oils, as also good spirit of wine, being shaken till they rise in bubbles, appear of various colours; which immediately vanish when the bubbles burst, so that a colourless liquor may be immediately made to exhibit a variety of colours, and lose them in a moment,

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moment, without any change in its essential principles. He then mentions the colours that appear in bubbles of soap and water, and also in those of turpentine. He sometimes got glass blown so thin as to exhibit similar colours; and observes, that a feather, and also a black ribbon, held at a proper distance, between his eye and the sun, showed a variety of little rainbows, with very vivid colours, none of which were constantly to be seen in the same objects.

31
Dr Hooke's account of these colours.

This subject was more carefully investigated by Dr Hooke, who promised, at a meeting of the society on the 7th of March 1672, to exhibit, at their next meeting, something which had neither reflection nor refraction, and yet was diaphanous. Accordingly he produced the famous coloured bubble of soap and water of which such use was afterwards made by Sir Isaac Newton, but which Dr Hooke and his contemporaries seem to have overlooked in Mr Boyle's treatise on colours, though it was published nine years before. It is no wonder that so curious an appearance excited the attention of that inquisitive body, and that they should desire him to bring an account of it in writing at their next meeting.

By the help of a small glass pipe, there were blown several small bubbles, out of a mixture of soap and water. At first, they appeared white and clear; but, after some time, the film of water growing thinner, there appeared upon it all the colours of the rainbow: First, a pale yellow; then orange, red, purple, blue, green, &c. with the same series of colours repeated; in which it was farther observable, that the first and last series were very faint, and that the middlemost series was very bright. After these colours had passed through the changes above mentioned, the film of the bubble began to appear white again; and presently, in several parts of this second white film, there were seen several holes, which by degrees grew very large, several of them running into one another.

Dr Hooke was the first who observed the beautiful colours that appear in thin plates of Muscovy glass. With a microscope he could perceive that these colours were ranged in rings surrounding the white specks or flaws in this thin substance, that the order of the colours was the very same as in the rainbow, and that they were often repeated ten times. But the colours were disposed as in the outer rainbow. Some of them also were much brighter than others, and some of them very much broader. He also observed, that if there was a part where the colours were very broad, and conspicuous to the naked eye, they might be made, by pressing the part with the finger, to change places, and move from one part to another. Lastly, He observed, that if great care be used, this substance may split into plates of one-eighth or one-sixth of an inch in diameter, each of which will appear through a microscope to be uniformly adorned with some one vivid colour, and that these plates will be found upon examination to be of the same thickness throughout.

A phenomenon similar to this was noticed by Lord Brereton, who at a meeting of the Royal Society in 1666, produced some pieces of glass taken out of a church window, both on the north and on the south side of it; they were all eaten in by the air, but the piece taken from the south side had some colours like those of the rainbow upon it, which the others on the north side had not. It cannot be doubted, but that in all these cases, the glass is divided into thin plates, which exhibit colours, upon the same principle with those which Dr Hooke observed in the bubble of soap and water, and in the thin plate of glass, which we shall find more fully explained by Sir Isaac Newton.

The inquiries of M. Bouguer concerning the reflection of light are worthy of particular notice. They are fully detailed in his *Traité d'Optique*, a posthumous work published by La Caille in 1760.

32
Discoveries of M. Bouguer.

In order to compare different degrees of light, he always contrived to place the radiant bodies or other bodies illuminated by them, in such a manner that he could view them distinctly at the same time; and he either varied the distances of these bodies, or modified their light in some other way, till he could perceive no difference between them. Then, considering their different distances, or the other circumstances by which their light was affected, he calculated the proportion which they would have borne to each other at the same distance, or in the same circumstances.

Plate CCCLXXV. fig. 3.

To ascertain the quantity of light lost by reflection, he placed the mirror, or reflecting surface, B, on which the experiment was to be made, truly upright; and having taken two tablets, of precisely the same colour, or of an equal degree of whiteness, he placed them exactly parallel to one another at E and D, and threw light upon them by means of a lamp or candle, P, placed in a right line between them. He then placed himself so, that with his eye at A he could see the tablet E, and the image of the tablet D, reflected from the mirror B, at the same time; making them as it were, to touch one another. He then moved the candle along the line ED, so as to throw more or less light upon either of them, till he could perceive no difference in the strength of the two lights that came to his eye. After this, he had nothing more to do than to measure the distances EP and DP, and then the intensity of the lights was as EP^2 to $\overline{DP}^2$.

Fig. 4.

To find how much light is lost by oblique reflection, he took two equally polished plates, D and E, and caused them to be enlightened by the candle P. While one of them, D, was seen at A, by reflection from B, placed in a position oblique to the eye, the other, E, was so placed, as to appear contiguous to it; and removing the plate E, till the light which it reflected was no stronger than that which came from the image D, seen by reflection at B, he estimated the quantity of light that was lost by this oblique reflection, by the squares of the distances of the two objects from the candle.

Fig. 5.

In order to ascertain the quantity of light lost by reflection with the greatest exactness, M. Bouguer introduced two beams of light into a darkened room, as by the apertures P and Q; which he had so contrived, that he could place them higher and lower, and enlarge or contract them at pleasure; and the reflecting surface (as that of a fluid contained in a vessel) was placed horizontally at O, from which the light coming through the hole P, was reflected to R upon the screen GH, where it was compared with another beam of light that fell upon S, through the hole Q; which he made so much less than P, as that the spaces S and R were equally illuminated; and by the proportion that the apertures P and Q bore to each other, he calculated what quantity of light was lost by the reflection at O.

It

It was necessary, he observes, that the two beams of light PO and QS (which he usually made 7 or 8 feet long) should be exactly parallel, that they might come from two points of the sky of the same altitude, and having precisely the same intensity of light. It was also necessary that the hole Q should be a little higher than P, in order that the two images should be at the same height, and near one another. It is no less necessary, he says, that the screen GH be exactly vertical, in order that the direct and reflected beams may fall upon it, with the same inclination; since, otherwise, though the two lights were perfectly equal, they would not illuminate the screen equally. This disposition, he says, serves to answer another important condition in these experiments; for the direct ray QS must be of the same length with the sum of the incident and reflected rays, PO and OR, in order that the quantity of light introduced into the room may be sensibly proportional to the sizes of the apertures.

Before we proceed to detail the other experiments of Bouguer, we shall notice some which were made previous to them by Buffon on the diminution of light by reflection, and the transmission of it to considerable distances through the air.

33
Experiment of M. Buffon.

By receiving the light of the sun in a dark room, and comparing it with the same light of the sun reflected by a mirror, he found that at small distances, as four or five feet, about one half was lost by reflection.

When the distances were 100, 200, and 300 feet, he could hardly perceive that it lost any of its intensity by being transmitted through such a space of air.

He afterwards made the same experiments with candles, in the following manner: He placed himself opposite to a looking glass, with a book in his hand, in a dark room; and having one candle lighted in the next room, at the distance of about 40 feet, he had it brought nearer to him by degrees, till he could just distinguish the letters of the book, which was then 24 feet from the candle. He then received the light of the candle, reflected by the looking glass, upon his book, carefully excluding all the light that was reflected from any thing else; and he found that the distance of the book from the candle, including the distance from the book to the looking glass (which was only half a foot) was in all 15 feet. He repeated the experiment several times, with nearly the same result; and therefore concluded, that the quantity of direct is to that of reflected light as 576 to 225; so that the light of five candles reflected from a plain mirror is about equal to that of two candles.

From these experiments it appeared, that more light was lost by reflection of the candles than of the sun, which M. Buffon thought was owing to this circumstance, that the light issuing from the candle diverges, and therefore falls more obliquely upon the mirror than the light of the sun, the rays of which are nearly parallel.

These experiments and observations of M. Buffon, though curious, are inferior to those of M. Bouguer, both in extent and accuracy.

34
M. Bouguer's discoveries concerning the reflection of glass and polished metal.

In order to ascertain the difference in the quantity of light reflected by glass and polished metal, he used a smooth piece of glass one line in thickness, and found that when it was placed at an angle of 15 degrees with the incident rays, it reflected 628 parts of 1000 which fell upon it; at the same time that a metallic mirror, which he tried in the same circumstances, reflected only 561 of them. At a less angle of incidence much more light was reflected: so that at an angle of three degrees the glass reflected 700 parts, and the metal something less, as in the former case.

In the case of unpolished bodies, he found that a piece of white plaster, placed at an angle of 75°, with the incident rays, reflected $\frac{1}{210}$ part of the light that is received from a candle nine inches from it. White paper, in the same circumstances, reflected in the same proportion; but at the distance of three inches, they both reflected 150 parts out of 1000.

Proceeding to make further observations on the subject of reflected light, he premises the two following theorems, which he demonstrates geometrically. 1. When the luminous body is at an infinite distance, and its light is received by a globe, the surface of which has a perfect polish, and absorbs no light, it reflects the light equally in all directions, provided it be received at a considerable distance. He excepts the place where the shadow of the globe falls: because this is no more than a single point, with respect to the immensity of the spherical surface which receives the light.

2. The quantity of light reflected in one certain direction will always be exactly the same, whether it be reflected by a very great number of small polished hemispheres, by a less number of large hemispheres, or by a single hemisphere, provided they occupy the same base, or cover the same ground plan.

The use he proposes to make of these theorems is to assist him in distinguishing whether the light reflected from bodies be owing to the extinction of it within them, or whether the eminences which cover them have not the same effect as the small polished hemispheres above mentioned.

He begins with observing, that of the light reflected from mercury, one fourth at least is lost, and that probably no substances reflect more than this. The rays were received at an angle of $11\frac{1}{4}$ degrees of incidence, that is measured from the surface of the reflecting body, and not from the perpendicular, which, he says, is what we are from this place to understand whenever he mentions the angle of incidence.

35
Great differences in the reflective power of substances according to the angle of incidence.

With regard to the quantities of light reflected at different angles of incidence, M. Bouguer found in general, that reflection is stronger at small angles of incidence, and weaker at large ones. The difference is excessive when the rays strike the surface of transparent substances, with different degrees of obliquity; but it is almost as great in some opaque substances, and it was always more or less so in every thing that he tried. He found the greatest inequality in black marble, which, though not perfectly polished, yet with an angle of 3° 35′ of incidence, it reflected almost as well as quicksilver. Of 1000 rays which it received, it returned 600: but when the angle of incidence was 14°, it reflected only 156; when it was 30°, it reflected 51; and when it was 80°, it reflected only 23.

Similar experiments made with metallic mirrors always gave the differences much less considerable. The greatest was hardly ever an eighth or a ninth part of it, but they were always in the same way.

The great difference between the quantity of light reflected from the surface of water, at different angles of incidence, is truly surprising. M. Bouguer sometimes suspected, that, when the angles of incidence were very

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very small, the reflection from water was even greater than from quicksilver; though he rather thought that it was scarcely so great. In very small angles, he says, that water reflects nearly $\frac{3}{4}$ of the direct light.

The light reflected from a lake is sometimes $\frac{1}{3}$ or $\frac{1}{4}$, or even a greater proportion, of the light that comes directly from the sun, which is an addition to the direct rays of the sun that cannot fail to be very sensible. The direct light of the sun diminishes gradually as it approaches the horizon, while the reflected light at the same time grows stronger: so that there is a certain altitude of the sun, in which the united force of the direct and reflected light will be the greatest possible, and this he says is 12 or 13 degrees.

The light reflected from water at great angles of incidence is extremely small. M. Bouguer was assured, that, when the light was perpendicular, it reflected no more than the 37th part that quicksilver does in the same circumstances; for it did not appear that water reflects more than the 60th, or rather the 55th, part of perpendicular light. When the angle of incidence was 50°, the light reflected from the surface of water was about the 32d part of that which mercury reflected; and as the reflection from water increases as the angle of incidence diminishes, it was twice as strong in proportion at 30°; for it was then the 16th part of the quantity reflected from mercury.

In order to procure a common standard by which to measure the proportion of light reflected from various fluid substances, he selected water as the most commodious; and partly by observation and calculation he drew up the following table of the quantity of light reflected from its surface at different angles of incidence.

Angles of incidence.	Rays reflected of 1000.	Angles of incidence.	Rays reflected of 1000.
$\frac{1}{2}$	721	$17\frac{1}{2}$	178
1	692	20	145
$1\frac{1}{2}$	669	25	97
2	639	30	65
$2\frac{1}{2}$	614	40	34
5	501	50	22
$7\frac{1}{2}$	409	60	19
10	333	70	18
$12\frac{1}{2}$	271	80	18
15	211	90	18

In the same manner, he constructed the following table containing the quantity of light reflected from the looking-glass not quicksilvered.

Angles of incidence.	Rays reflected of 1000.	Angles of incidence.	Rays reflected of 1000.
$2\frac{1}{2}$	584	30	112
5	543	40	57
$7\frac{1}{2}$	474	50	34
10	412	60	27
$12\frac{1}{2}$	356	70	25
15	299	80	25
20	222	90	25
25	157		

When water floats upon mercury there will be two images of any object seen by reflection from them, one at the surface of the water, and the other at that of the quicksilver. In the largest angles of incidence, the image at the surface of the water will disappear, which will happen when it is about a 60th or an 80th part less luminous than the image at the surface of the quicksilver. Depressing the eye, the image on the water will grow stronger, and that on the quicksilver weaker in proportion; till at last, the latter will be incomparably weaker than the former, and at an angle of about 10 degrees they will be equally luminous. According to the table, $\frac{333}{1000}$ of the incident rays are reflected from the water at this angle of 10 degrees. At the surface of the mercury they were reduced to 500; and of these, part being reflected back upon it from the under surface of the water, only 333 remained to make the image from the mercury.

36
Reflection of images by the air.

It has been frequently observed, that there is a remarkably strong reflection into water, with respect to rays issuing from the water; and persons under water have seen images of things in the air in a manner peculiarly distinct and beautiful. In order to account for these facts, M. Bouguer observes that from the smallest angles of incidence, to a certain number of degrees, the greatest part of the rays are reflected, perhaps, in as great a proportion as at the surface of metallic mirrors, or of quicksilver; while the other part, which does not escape into the air, is extinguished or absorbed; so that the surface of the transparent body appears opaque on the inside. If the angle of incidence be increased only a few degrees, the strong reflection ceases altogether, a great number of rays escape into the air, and very few are absorbed. As the angle of incidence is farther increased, the quantity of the light reflected becomes less and less; and when it is near 90 degrees, almost all the rays escape out of the transparent body, its surface losing almost all its power of reflection, and becoming nearly as transparent as when the light falls upon it from without.

37
Extinction of the rays of light at the surface of transparent bodies.

This property belonging to the surfaces of transparent bodies, of absorbing the rays of light, is truly remarkable, and, as there is reason to believe, had not been noticed by any person before Bouguer.

38
Strong reflection by a prism.

That all the light is reflected at certain angles of incidence from air into denser substances, had frequently been noticed, especially in glass prisms; so that Newton made use of one of them, instead of a mirror, in the construction of his reflecting telescope. If a beam of light fall upon the air from within these prisms, at an angle of 10, 20, or 30 degrees, the effect will be nearly the same as at the surface of quicksilver, one-fourth or one-third of the rays being extinguished, and two-thirds or three-fourths reflected. This property retains its full force as far as an angle of 49° 49′, (the proportion of the sines of the refraction being 31 and 20); but if the angle of incidence be increased but one degree, the quantity of light reflected inwards suddenly decreases, and a great part of the rays escape out of the glass, so that the surface becomes suddenly transparent.

All transparent bodies have the same property, with this difference, that the angle of incidence at which the strong reflection ceases, and at which the light which is not reflected is extinguished, is greater in some than in others. In water this angle is about 41° 32′; and in every medium it depends so much on the invariable

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proportion of the sine of the angle of refraction to the sine of the angle of incidence, that this law alone is sufficient to determine all the phenomena of this new circumstance, at least as to this accidental opacity of the surface.

When M. Bouguer proceeded to measure the quantity of light reflected by these internal surfaces at great angles of incidence, he had to struggle with many difficulties; but by using a plate of crystal, he found, that at an angle of 75 degrees, this internal reflection diminished the light 27 or 28 times; and as the external reflection at the same angle diminished the light only 26 times, it follows that the internal reflection is a little stronger than the other.

Repeating these experiments with the same and different pieces of crystal, he sometimes found the two reflections to be equally strong; but, in general, the internal was the stronger.

39 Of the quantity of light reflected by different substances

Resuming his observations on the diminution of light, occasioned by the reflection of opaque bodies obliquely situated, he compared it with the appearances of similar substances which reflected the light perpendicularly. Using pieces of silver made very white, he found, that when one of them was placed at an angle of 75 degrees with respect to the light, it reflected only 640 parts out of 1000. He then varied the angle, and also used white plaster and fine Dutch paper, and drew up the following table of the proportion of the light reflected from each of those substances at certain angles.

Angles of incidence.	Quantity of Light reflected from Silver.	Plaster.	Dutch Paper.
90	1000	1000	1000
75	802	762	971
60	640	640	743
45	455	529	507
30	319	352	332
15	209	194	203

Supposing the asperities of opaque bodies to consist of very small planes, it appears from these observations, that there are fewer of them in those bodies which reflect the light at small angles of incidence than at greater. None of them had their roughness equivalent to small hemispheres, which would have dispersed the light equally in all directions; and, from the *data* in the preceding table, he deduces mathematically the number of the planes that compose those surfaces, and that are inclined to the general surface at the angles above mentioned, supposing that the whole surface contains 1000 of them that are parallel to itself, so as to reflect the light perpendicularly, when the luminous body is situated at right angles with respect to it. His conclusions reduced to a table, corresponding to the preceding, are as follow:

Inclinations of the small surfaces with respect to the large one.	The distribution of the small planes that constitute the asperities of the opaque surface in the Silver.	Plaster.	Paper.
0	1000	1000	1000
15	777	736	937
30	554	554	545
45	333	374	358
60	161	176	166
75	53	50	52

These variations in the number of little planes, he expresses in the form of a curve; and afterwards shows, geometrically, what would be the effect if the bodies were enlightened in one direction, and viewed in another. Upon this subject he has several curious theorems and problems; but for these we must refer to the work itself.

Since the planets are more luminous at their edges than at their centres, he concludes, that the bodies which form them are constituted in a manner different from ours; particularly that their opaque surfaces consist of small planes, more of which are inclined to the general surface than they are in terrestrial substances; and that there are in them an infinity of points, which have exactly the same splendour.

M. Bouguer next proceeds to ascertain the quantity of surface occupied by the small planes of each particular inclination, from considering the quantity of light reflected by each, allowing those that have a greater inclination to the common surface to take up proportionably less space than those which are parallel to it. And comparing the quantity of light that would be reflected by small planes thus disposed, with the quantity of light that was actually reflected by the three substances above mentioned, he found that plaster, notwithstanding its extreme whiteness, absorbs much light; for that, of 1000 rays falling upon it, of which 166 or 167 ought to be reflected at an angle of 77°, only 67 are in fact returned; so that 100 out of 167 were extinguished, that is, about three-fifths.

With respect to the planets, Bouguer concludes, that of 300,000 rays which the moon receives, 172,000, or perhaps 204,100, are absorbed.

Having considered the surfaces of bodies as consisting of planes only, he observes that each small surface, separately taken, is extremely irregular, some of them really concave, and others convex; but, in reducing them to a middle state, they are to be regarded as planes. Nevertheless he considers them as planes only with respect to the reception of the rays; for as they are almost all curves, and as, besides this, many of those whose situation is different from others contribute to the same effects, the rays always issue from an actual or imaginary focus, and after reflection always diverge from another.

The experiments of Lambert, related in his *Photometria*, have laid open to us many curious observations concerning the natural history of light. He was the first who determined that a radiating surface emits its light with nearly the same intensity in all directions, so that

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that every portion of it appears equally bright to an observer placed in any direction.

42
Mr Melville's observations on the manner in which bodies are heated by light.

We are obliged to Mr Melville for some ingenious observations on the manner in which bodies are heated by light. He observes, that, as each colorific particle of an opaque body must be somewhat moved by the reflection of the particles of light, when it is reflected backwards and forwards between the same particles, it is manifest that they must likewise be agitated with a vibratory motion, and the time of a vibration will be equal to that which light takes up in moving from one particle of a body to another adjoining. This distance, in the most solid opaque bodies, cannot be supposed greater than $\frac{1}{12500}$th of an inch, which space light describes in the $\frac{1}{125000000000000}$th of a second. With so rapid a motion, therefore, may the internal parts of bodies be agitated by the influence of light, as to perform 125,000,000,000,000 vibrations, or more, in a second of time.

The arrival of different particles of light at the surface of the same colorific particle, in the same or different rays, may disturb the regularity of its vibrations, but will evidently increase their frequency, or raise still smaller vibrations among the parts which compose those particles; whence the intestine motion will become more subtle, and more thoroughly diffused. If the quantity of light admitted into the body be increased, the vibrations of the particles must likewise increase in magnitude and velocity, till at last they may be so violent, as to make all the component particles dash one another to pieces by their mutual collision; in which case, the colour and texture of the body must be destroyed.

Since there is no reflection of light but at the surface of a medium, the same gentleman observes, that the greatest quantity of rays, though crowded into the smallest space, will not of themselves produce any heat. Hence it follows, that the portion of air which lies in the focus of the most potent speculum, is not at all affected by the passage of light through it, but continues of the same temperature with the ambient air; though any opaque body, or even any transparent body denser than air, when put in the same place, would, in an instant, be intensely heated.

The easiest way to be satisfied of this truth experimentally is, to hold a hair, or a piece of down, immediately above the focus of a lens or speculum, or to blow a stream of smoke from a pipe horizontally over it; for if the air in the focus were hotter than the surrounding fluid, it would continually ascend on account of its rarefaction, and thereby sensibly agitate those slender bodies. Or a lens may be so placed as to form its focus within a body of water, or some other transparent substance, the heat of which may be examined from time to time with a thermometer; but care must be taken, in this experiment, to hold the lens as near as possible to the transparent body, lest the rays, by falling closer than ordinary on its surface, should warm it more than the common sunbeams. See Priestley on Vision.

43
Abbé Nollet's experiments with burning glasses.

The attempts of the Abbé Nollet to fire inflammable substances by the concentration of the solar rays, have a near relation to the present subject. He attempted to fire liquid substances, but he was not able to do it either with spirit of wine, olive oil, oil of turpentine, or ether; and though he could fire sulphur, yet he could not succeed with Spanish wax, rosin, black pitch, or suet. He both threw the focus of these mirrors upon the substances themselves, and also upon the fumes that rose from them; but the only effect was, that the liquor boiled, and was dispersed in vapour or very small drops. When linen rags, and other solid substances, were moistened with any of these inflammable liquids, they would not take fire till the liquid was dispersed in a copious fume; so that the rags thus prepared were longer in burning than those that were dry.

44
M. Beaume's experiments.

M. Beaume, who assisted M. Nollet in some of these experiments, observed farther, that the same substances which were easily fired by the flame of burning bodies, could not be set on fire by the contact of the hottest bodies that did not actually flame. Neither ether nor spirit of wine could be fired with a hot coal, or even red-hot iron, unless they were of a white heat.

45
Bodies which seem to touch one another are not in actual contact.

By the help of optical principles, and especially by observations on the reflection of light, Mr Melville demonstrated that bodies which seem to touch one another are not always in actual contact. Upon examining the volubility and lustre of drops of rain that lie on the leaves of colewort, and some other vegetables, he found that the lustre of the drop is produced by a copious reflection of light from the flattened part of its surface contiguous to the plant. He found also, that, when the drop rolls along a part which has been wetted, it immediately loses all its lustre, the green plant being then seen clearly through it; whereas, in the other case, it is hardly to be discerned.

From these two observations, he concluded, that the drop does not really touch the plant, when it has the mercurial appearance, but is suspended in the air at some distance from it by a repulsive force. For there could not be any copious reflection of white light from its under surface, unless there were a real interval between it and the surface of the plant.

If that surface were perfectly smooth, the under surface of the drop would be so likewise, and would therefore show an image of the illuminating body by reflection, like a piece of polished silver; but as it is considerably rough, the under surface becomes rough likewise, and thus by reflecting the light copiously in different directions, assumes the brilliant hue of unpolished silver.

It being thus proved by an optical argument, that the drop is not really in contact with the leaf, it may easily be conceived whence its volubility arises, and why it leaves no moisture where it rolls.

46
Two curious miscellaneous observations.

Before we conclude the history of the observations concerning the reflection of light, we must not omit to take notice of two singular miscellaneous observations. Baron Alexander Funk, visiting some silver mines in Sweden, observed, that, in a clear day, it was as dark as pitch below ground, in the eye of a pit, at 60 or 70 fathoms deep; whereas, in a cloudy or rainy day, he could even see to read at the depth of 106 fathoms. He imagined that it arose from this circumstance, that when the atmosphere is full of clouds, light is reflected from them into the pit in all directions, and that thereby a considerable proportion of the rays is reflected perpendicularly upon the earth; whereas, when the atmosphere is clear, there are no opaque bodies to reflect the light in this manner, at least in a sufficient quantity; and rays from the sun itself can never fall perpendicularly in that country.

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The other observation was that of the ingenious Mr Grey. He took a piece of stiff brown paper, and pricking a small hole in it, he held it at a little distance before him; when, applying a needle to his eye, he was surprised to see the point of it inverted. The nearer the needle was to the hole, the more it was magnified, but the less distinct; and if it was so held, that its image was near the edge of the hole, its point seemed crooked. From these appearances he concluded, that these small holes, or something in them, produce the effects of concave speculums; and from this circumstance he took the liberty to call them *aërial speculums.*

This method of accounting for the inverted image of the pin is evidently erroneous; for the same effect is produced, when the small aperture is formed of two semi-apertures at different distances from the eye, or when a small opening is made in the pigment on a piece of smoked glass. We have found indeed that the same phenomenon will appear, if, instead of looking at a hole in a piece of paper, we view a small luminous point so that it is expanded by indistinct vision into a circular image of light. The pin always increases in magnitude in proportion to its distance from the luminous point.

SECT. III. *Discoveries concerning the Inflection of Light.*

This property of light was not discovered till about the middle of the 17th century. The person who first made the discovery was Father Grimaldi; at least he first published an account of it in his treatise *De lumine, coloribus, et iride*, printed in 1666. Dr Hooke, however, laid claim to the same discovery, though he did not make his observations public till six years after Grimaldi.

47 Dr Hooke's discoveries. Dr Hooke having darkened his room, admitted a beam of the sun's light through a very small hole in a brass plate. This beam spreading itself, formed a cone, the vertex of which was in the hole, and the base was on a paper, so placed as to receive it at some distance. In the image of the sun, thus painted on the paper, he observed that the middle was much brighter than the edges, and that there was a kind of dark penumbra about it, of about a 16th part of the diameter of the circle; which he ascribed to a property of light, that he promised to explain.—Having observed this, at the distance of about two inches from the former he let in another cone of light; and receiving the bases of them, at such a distance from the holes that the circles intersected each other, he observed that there was not only a darker ring, encompassing the lighter circle, but a manifest dark line, or circle, as in fig. 6. which appeared even where the limb of the one interfered with that of the other.

Plate CCLXXV Fig. 6.

Fig. 7.

In the light thus admitted, he held an opaque body BB, fig. 7. so as to intercept the light that entered at a hole in the window shutter O, and was received on the screen AP. In these circumstances, he observed, that the shadow of the opaque body (which was a round piece of wood, not bright or polished) was all over somewhat enlightened, but more especially towards the edge. In order to show that this light was not produced by reflection, he admitted the light through a hole burnt in a piece of pasteboard, and intercepted it with a razor which had a very sharp edge; but still the appearances were the very same as before; so that he concluded that they were occasioned by some new property of light.

He diversified this experiment, by placing the razor so as to divide the cone of light into two parts, and placing the paper so that none of the enlightened part of the circle fell upon it, but only the shadow of the razor; and, to his great surprise, he observed what he calls a *very brisk and visible radiation* striking down upon the paper, of the same breadth with the diameter of the lucid circle. This radiation always struck perpendicularly from the line of shadow, and, like the tail of a comet, extended more than 10 times the breadth of the remaining part of the circle. He found, wherever there was a part of the interposed body higher than the rest, that, opposite to it, the radiation of light into the shadow was brighter, as in the figure; and wherever there was a notch or gap in it, there would be a dark stroke in the half-enlightened shadow. From all these appearances, he concluded, that there is a deflection of light, differing both from reflection and refraction, and seeming to depend on the unequal density of the constituent parts of the ray, whereby the light is dispersed from the place of condensation, and rarefied, or gradually diverged into a quadrant; that this deflection is made towards the superficies of the opaque body perpendicularly; that those parts of the diverged radiations which are deflected by the greatest angle from the straight or direct radiations are the faintest, and those that are deflected by the least angles are the strongest; that rays cutting each other in one common aperture do not make the angles at the vertex equal; that colours may be made without refraction; that the diameter of the sun cannot be truly taken with common sights; that the same rays of light, falling upon the same point of an object, will turn into all sorts of colours, by the various inclinations of the object; and that colours begin to appear when two pulses of light are blended so well, and so near together, that the sense takes them for one.

We shall now proceed to give an account of the discoveries of Father Grimaldi. Having introduced a ray of light, through a very small hole, AE, fig. 8. into a darkened room, he observed that the light was diffused in the form of a cone, the base of which was CD; and that if any opaque body, FE, was placed in this cone of light, at a considerable distance from the hole, and the shadow received upon a piece of white paper, the boundaries of it were not confined within GH, or the penumbra IL, occasioned by the light proceeding from different parts of the aperture, and of the disk of the sun, but extended to MN: At this he was very much surprised, as he found that it was broader than it ought to have been made by rays passing in right lines by the edges of the object. 48 Grimaldi's discoveries. Fig. 8.

But the most remarkable circumstance in this appearance was, that upon the lucid part of the base, CM and ND, streaks of coloured light were plainly distinguished, each being terminated by blue on the side next the shadow, and by red on the other; and though these coloured streaks depended, in some measure on the size of the aperture AB, because they could not be made to appear if it was large, yet he found that they were not limited either by it, or by the diameter of the sun's disk.

He farther observed, that these coloured streaks were

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Fig. 9. To give a clearer idea of these coloured streaks, he drew the representation of them, exhibited in fig. 9. in which NMO represents the largest and most luminous streak, next to the dark shadow X. In the space in which M is placed there was no distinction of colour, but the space NN was blue, and the space OO on the other side of it was red. The second streak QPR was narrower than the former; and of the three parts of which it consisted, the space P had no particular colour, but QQ was a faint blue, and RR a faint red. The third streak, TSV, was exactly similar to the two others, but narrower than either of them, and the colour still fainter.

These coloured streaks he observed to lie parallel to the shadow of the opaque body; but when it was of an angular form, they did not make the same acute angles, but were bent into a curve, the outermost being rounder than those that were next the shadow, as is represented in fig. 10. If it was an inward angle, as DCH, the coloured streaks, parallel to each other of the two sides crossed without obliterating one another; only the colours were thus rendered either more intense or mixed.

Fig. 10.

Within the shadow itself, Grimaldi sometimes perceived coloured streaks, similar to those above mentioned on the outside of the shadow. Sometimes he saw more of them, and sometimes fewer; but for this purpose it was necessary to have strong light, and to make the opaque body long and moderately broad. A hair, for instance, or a fine needle, did not answer so well as a thin and narrow plate: and the streaks were most distinguishable when the shadow was taken at the greatest distance; though the light grew fainter in the same proportion.

The numbers of these streaks increased with the breadth of the plate. They were at least two, and sometimes four, if a thicker plate were made use of. But, with the same plate, more or fewer streaks appeared, in proportion to the distance at which the shadow was received; but they were broader when they were few, and narrower when there were more of them; and they were all much more distinct when the paper was held obliquely.

Fig. 11. These coloured streaks, like those on the outside of the shadow, were bent in an arch, round the acute angles of the shadow, as they are represented in fig 11. At this angle also, as at D, other shorter lucid streaks were visible, bent in the form of a plume, as they are drawn betwixt D and C, each bending round and meeting again in D. These angular streaks appeared, though the plate or rod was not wholly immersed in the beam of light, but the angle of it only; and they increased in number with the breadth of the plate. If the plate was very thin, the coloured streaks bent round from the opposite sides, and met one another as at B.

In order to obtain a more satisfactory proof, that rays of light really bend, in passing by the edges of bodies, he admitted a beam of light into a dark room, as before; and, at a great distance from it, he fixed a plate EF, (fig. 12.) with a small aperture GH, which admitted only a part of the beam of light, and found, that when the light transmitted through this plate was received at some distance upon a white paper, the base IK was considerably larger than it could possibly have been made by rays issuing in right lines through the two apertures. Grimaldi generally made the aperture CD $\frac{4}{100}$ or $\frac{5}{100}$ part of a foot, and the second aperture, GH, $\frac{25}{100}$ or $\frac{10}{100}$; and the distances, DG and GN, were at least 12 feet. The observation was made about midday in the summer time, when the atmosphere was free from all vapours.

Fig. 12.

Grimaldi also made the same experiment that has been recited from Dr Hooke, in which two beams of light, entering a dark room by two small apertures near one another, projected cones of light, which, at a certain distance, in part coincided; and he particularly observed, that the dark boundaries of each of them were visible within the lucid ground of the other.

49 Observation of Dechales.

To these discoveries of Grimaldi, we shall subjoin an additional observation of Dechales; who found, that if a piece of polished metal, with small scratches in it, be exposed to the beams of the sun in a darkened room, it will reflect the rays streaked with colours in the direction of the scratches; as will appear, if the reflected light be received upon a piece of white paper. That these colours are not produced by refraction, he says, is manifest; for if the scratches be made upon glass, the effect will be the same; and in this case, if the light had been refracted at the surface of the glass, it would have been transmitted through it. From these and many other observations, he concluded, that colour does not depend upon the refraction of light only, nor upon a variety of other circumstances which he particularly enumerates, but upon the intensity of the light only.

50 Of M. de la Hire.

We shall here give an account of the phenomenon of vision observed by M. de la Hire, as being connected with the subject of this section. When we look at a candle, or any luminous body, with our eyes nearly shut, rays of light are extended from it, in several directions, to a considerable distance, like the tails of comets. This appearance exercised the sagacity of Descartes and Rohault, as well as of De la Hire; but all these philosophers seem to have been mistaken with regard to its cause. Descartes ascribed this effect to certain wrinkles in the surface of the humours of the eyes Rohault says, that when the eye-lids are nearly closed, the edges of them act like convex lenses. But De la Hire observes, that the moisture on the surface of the eye, adhering partly to the eye itself, and partly to the edge of the eye-lid, makes a concave mirror, and so disperses the rays at their entrance into the eye. The true account of the phenomenon, however, is this. There are three different kinds of radiations distinctly visible; the most brilliant, which diverge directly from the candle, are formed by the *refraction* of the light of the candle through the moisture that lubricates the eye, and which is brought opposite the pupil by one of the eye-lids. Another kind of radiation, which appears at a distance from the candle in the form of small luminous specks, is produced by *reflection* from the part of the eye-lid in which the lashes are

are inserted. The third kind of radiation is horizontal, and is caused by the *inflection* of the light in passing between the eye-lashes.

51
Sir Isaac Newton's discoveries.

The experiments of Grimaldi and Hooke were repeated and extended by Sir Isaac Newton, and were in some measure explained by that distinguished philosopher.

He made in a piece of lead a small hole the 42d part of an inch in diameter. Through this hole he let into his dark chamber a beam of the sun's light; and found, that the shadows of hairs, and other slender substances, placed in it, were considerably broader than they would have been if the rays of light had passed by those bodies in right lines. He therefore concluded, that they must have passed as they are represented in fig. 1. in which X represents a section of the hair, and AD, BE, &c. rays of light passing by at different distances, and then falling upon the wall GQ. Since, when the paper which receives the rays is at a great distance from the hair, the shadow is broad, it must follow, that the hair acts upon the rays at some considerable distance from it, the action being strongest on those rays which are at the least distance, and growing weaker and weaker on those which are farther off, as is represented in this figure; and hence it comes to pass that the shadow of the hair is much broader in proportion to the distance of the paper from the hair when it is nearer than when it is at a greater distance.

Plate CCLXXVI. fig. 1.

By wetting a polished plate of glass, and laying the hair in the water upon the glass, and then laying another polished plate of glass upon it, so that the water might fill up the space between the glasses, he found that the shadow at the same distance was as big as before, so that this breadth of shadow must proceed from some other cause than the refraction of the air.

The shadows of all bodies placed in this light were bordered with three parallel fringes of coloured light, of which that which was nearest to the shadow was the broadest and most luminous, while that which was farthest from it was the narrowest, and so faint as to be scarcely visible. It was difficult to distinguish these colours, unless when the light fell very obliquely upon some smooth white body, so as to make them appear much broader than they would otherwise have done; but in these circumstances the colours were plainly visible, and in the following order. The first or innermost fringe was violet, and deep blue next the shadow, light blue, green, and yellow in the middle, and red without.

The second fringe was almost contiguous to the first, and the third to the second; and both were blue within, and yellow and red without; but their colours were very faint, especially those of the third. The colours, therefore, proceeded in the following order from the shadow; violet, indigo, pale blue, green, yellow, red; blue, yellow, red; pale blue, pale yellow, and red. The shadows, made by scratches and bubbles in polished plates of glass, were bordered with the like fringes of coloured light.

Measuring these fringes and their intervals with the greatest accuracy, he found the former to be in the progression of the numbers 1, $\sqrt{\frac{1}{3}}$, $\sqrt{\frac{1}{5}}$, and their intervals to be in the same progression with them, that is, the fringes and their intervals together to be nearly in continual progression of the numbers 1, $\sqrt{\frac{1}{2}}$, $\sqrt{\frac{1}{3}}$, $\sqrt{\frac{1}{4}}$, $\sqrt{\frac{1}{5}}$.

Having made the aperture $\frac{1}{4}$ of an inch in diameter, and admitted the light as formerly, Sir Isaac placed, at the distance of two or three feet from the hole, a sheet of pasteboard, black on both sides; and in the middle of it he made a hole about $\frac{1}{4}$ of an inch square, and behind the hole he fastened to the pasteboard the blade of a sharp knife, to intercept some part of the light which passed through the hole. The planes of the pasteboard and blade of the knife were parallel to each other, and perpendicular to the rays; and when they were so placed that none of the light fell on the pasteboard, but all of it passed through the hole to the knife, and there part of it fell upon the blade of the knife, and part of it passed by its edge, he let that part of the light which passed fall on a white paper, 2 or 3 feet beyond the knife, and there he saw two streams of faint light shoot out both ways from the beam of light into the shadow. But because the sun's direct light, by its brightness upon the paper, obscured these faint streams, so that he could scarcely see them, he made a little hole in the midst of the paper for that light to pass through and fall on a black cloth behind it; and then he saw the two streams plainly. They were similar to one another, and pretty nearly equal in length, breadth, and quantity of light. Their light, at that end which was next to the sun's direct light, was pretty strong for the space of about $\frac{1}{4}$ of an inch, or $\frac{1}{2}$ of an inch, and gradually decreased till it became insensible.

The whole length of either of these streams, measured upon the paper, at the distance of 3 feet from the knife, was about 6 or 8 inches; so that it subtended an angle, at the edge of the knife, of about 10 or 12, or at most 14, degrees. Yet sometimes he thought he saw it shoot 3 or 4 degrees farther; but with a light so very faint, that he could hardly perceive it. This light he suspected might, in part at least, arise from some other cause than the two streams. For, placing his eye in that light, beyond the end of that stream which was behind the knife, and looking towards the knife, he could see a line of light upon its edge; and that not only when his eye was in the line of the streams, but also when it was out of that line, either towards the point of the knife, or towards the handle. This line of light appeared contiguous to the edge of the knife, and was narrower than the light of the innermost fringe, and narrowest when his eye was farthest from the direct light; and therefore seemed to pass between the light of that fringe and the edge of the knife; and that which passed nearest the edge seemed to be most bent.

He then placed another knife by the former, so that their edges might be parallel, and look towards one another, and that the beam of light might fall upon both the knives, and some part of it pass between their edges. In this situation he observed, that when the distance of their edges was about the 400th of an inch, the stream divided in the middle, and left a shadow between the two parts. This shadow was so dark, that all the light which passed between the knives seemed to be bent to the one hand or the other; and as the knives still approached each other, the shadow grew broader and the streams shorter next to it, till, upon the contact of the knives, all the light vanished.

Hence Sir Isaac concluded, that the light which is least bent, and which goes to the inward ends of the streams, passes by the edges of the knives at the greatest distance;

distance; and this distance, when the shadow began to appear between the streams, was about the 800th of an inch; and the light which passed by the edges of the knives at distances still less and less, was more and more faint, and went to those parts of the streams which were farther from the direct light; because, when the knives approached one another till they touched, those parts of the stream vanished last which were farthest from the direct line.

In the experiment of one knife only, the coloured fringes did not appear; but, on account of the breadth of the hole in the window, became so broad as to run into one another, and, by joining, to make one continual light in the beginning of the streams; but in the last experiment, as the knives approached one another, a little before the shadow appeared between the two streams, the fringes began to appear on the inner ends of the streams, on either side of the direct light; three on one side, made by the edge of one knife, and three on the other side, made by the edge of the other knife. They were the most distinct when the knives were placed at the greatest distance from the hole in the window, and became still more distinct by making the hole less; so that he could sometimes see a faint trace of a fourth fringe beyond the three above mentioned: and as the knives approached one another the fringes grew more distinct and larger, till they vanished; the outermost vanishing first, and the innermost last. After they were all vanished, and the line of light in the middle between them was grown very broad, extending itself on both sides into the streams of light described before, the above mentioned shadow began to appear in the middle of this line, and to divide it along the middle into two lines of light, and increased till all the light vanished. This enlargement of the fringes was so great, that the rays which went to the innermost fringe seemed to be bent about 20 times more when the fringe was ready to vanish, than when one of the knives was taken away.

From both these experiments Newton concluded, that the light of the first fringe passed by the edge of the knife at a distance greater than the 800th of an inch; that the light of the second fringe passed by the edge of the knife at a greater distance than the light of the first fringe, and that of the third at a greater distance than that of the second; and that the light of which the streams above mentioned consisted, passed by the edges of the knives at less distances than that of any of the fringes.

He then got the edges of two knives ground straight, and fixed their points into a board, so that their edges might contain a rectilinear angle. The distance of the edges of the knives from one another, at four inches from the angular point, was the 8th of an inch; so that the angle contained by their edges was about 1° 54′. The knives being thus fixed, he placed them in a beam of the sun's light let into his darkened chamber, through a hole the 42d of an inch wide, at the distance of 10 or 13 feet from the hole; and he let the light which passed between their edges fall very obliquely on a smooth white ruler, at the distance of ½ inch, or an inch, from the knives; and there he saw the fringes made by the two edges of the knives run along the edges of the shadows of the knives, in lines parallel to those edges, without growing sensibly broader, till they met in angles equal to the angle contained by the edges of the knives; and where they met and joined, they ended, without crossing one another. But if the ruler was held at a much greater distance from the knives, the fringes, where they were farther from the place of their meeting, were a little narrower, and they became something broader as they approached nearer to one another, and after they met they crossed one another, and then became much broader than before.

From these observations he concluded, that the distances at which the light composing the fringes passed by the knives were not increased, or altered by the approach; and that the knife which was nearest to any ray determined which way the ray should be bent, but that the other knife increased the bending.

When the rays fell very obliquely upon the ruler, at the distance of ⅓ of an inch from the knives, the dark line between the first and second fringes of the shadow of one knife, and the dark line between the first and second fringe of the shadow of the other knife, met one another, at the distance of ⅕ of an inch from the end of the light which passed between the knives, where their edges met; so that the distance of the edges of the knives, at the meeting of the dark lines, was the 160th of an inch; and one half of that light passed by the edge of one knife, at a distance not greater than the 320th part of an inch, and, falling upon the paper, made the fringes of the shadow of that knife; while the other half passed by the edge of the other knife, at a distance not greater than the 320th part of an inch, and, falling upon the paper, made the fringes of the shadow of the other knife. But if the paper was held at a distance from the knives greater than ⅓ of an inch, the dark lines above mentioned met at a greater distance than ⅕ of an inch from the end of the light which passed between the knives, at the meeting of their edges; so that the light which fell upon the paper where those dark lines met passed between the knives, where their edges were farther distant than the 160th of an inch. For at another time, when the two knives were 8 feet 5 inches from the little hole in the window, the light which fell upon the paper where the above mentioned dark lines met passed between the knives, where the distance between their edges was, as in the following table, at the distances from the paper noted.

Distance of the paper from the knives in inches.	Distance between the edges of the knives in thousandth parts of an inch.
1½	0,012
3⅓	0,020
8⅗	0,034
32	0,057
96	0,081
131	0,087

From these observations he concluded, that the light which forms the fringes upon the paper is not the same light at all distances of the paper from the knives; but that when the paper is held near the knives, the fringes are made by light which passes by the

the edges of the knives at a less distance, and is more bent than when the paper is held at a greater distance from the knives.

When the fringes of the shadows of the knives fell perpendicularly upon the paper, at a great distance from the knives, they were in the form of hyperbolas, of the following dimensions Let CA, CB, (fig. 2.) represent lines drawn upon the paper, parallel to the edges of the knives; and between which all the light would fall if it suffered no inflection. DE is a right line drawn through C, making the angles ACD, BCE, equal to one another, and terminating all the light which falls upon the paper, from the point where the edges of the knives meet, Then *e i s*, *f k t*, and *g l v*, will be three hyperbolic lines, representing the boundaries of the shadow of one of the knives, the dark line between the first and second fringes of that shadow, and the dark line between the second and third fringes of the same shadow. Also *x i p*, *y k q*, and *z l r*, will be three other hyperbolic lines, representing the boundaries of the shadow of the other knife, the dark line between the first and second fringes of that shadow, and the dark line between the second and third fringes of the same shadow. These three hyperbolas, which are similar, and equal to the former, cross them in the points *i*, *k*, and *l*; so that the shadows of the knives are terminated, and distinguished from the first luminous fringes, by the lines *e i s*, and *x i p*, till the meeting and crossing of the fringes; and then those lines cross the fringes in the form of dark lines terminating the first luminous fringes on the inside, and distinguishing them from another light, which begins to appear at *i*, and illuminates all the triangular space *i p* DE *s*, comprehended by these dark lines and the right line DE. Of these hyperbolas one asymptote is the line DE, and the other asymptotes are parallel to the lines CA and CB.

Plate CCLXXVI fig. 2.

Before the small hole in the window Newton placed a prism, to form on the opposite wall the coloured image of the sun; and he found that the shadows of all bodies held in the coloured light, were bordered with fringes of the colour of the light in which they were held; and he found that those made in the red light were the largest, those made in the violet the least, and those made in the green of a middle bigness. The fringes with which the shadow of a man's hair were surrounded, being measured across the shadow, at the distance of six inches from the hair, the distance between the middle and most luminous part of the first or innermost fringe on one side of the shadow, and that of the like fringe on the other side of the shadow, was, in the full red light $\frac{1}{37\cdot5}$ of an inch, and in the full violet $\frac{1}{46}$. The like distance between the middle and most luminous parts of the second fringes, on either side of the shadow, was in the full red light $\frac{1}{22}$, and in the violet $\frac{1}{27}$ of an inch; and these distances of the fringes held the same proportion at all distances from the hair, without any sensible variation.

From these observations it was evident, that the rays which formed the fringes in the red light, passed by the hair at a greater distance than those which made the like fringes, in the violet; so that the hair, in causing these fringes, acted alike upon the red light or least refrangible rays at a greater distance, and upon the violet or most refrangible rays at a less distance; and thereby occasioned fringes of different sizes, without any change in the colour of any sort of light.

It may therefore be concluded, that when the hair was held in the white beam of light, and cast a shadow bordered with three coloured fringes, those colours arose not from any new modifications impressed upon the rays of light by the hair, but only from the various inflections by which the several sorts of rays were separated from one another, which before separation, by the mixture of all their colours, composed the white beam of the sun's light; but, when separated, composed lights of the several colours which they are originally disposed to exhibit.

52 Maraldi's discoveries.

The person who first made any experiments similar to those of Newton on inflected light is M. Maraldi. His observations chiefly respect the inflection of light towards other bodies, whereby their shadows are partially illuminated.

53 Experiments concerning the shadows of cylinders.

He exposed in the light of the sun a cylinder of wood three feet long, and $6\frac{1}{2}$ lines in diameter, when its shadow was everywhere equally black and well defined, even at the distance of 23 inches from it. At a greater distance the shadow appeared of two different densities; for its two extremities, in the direction of the length of the cylinder, were terminated by two dark strokes, a little more than a line in breadth. Within these dark lines there was a faint light, equally dispersed through the shadow, which formed an uniform penumbra, much lighter than the dark strokes at the extremity, or than the shadow received near the cylinder. This appearance is represented in Plate CCCLXXVI. fig. 3. Fig. 5.

As the cylinder was removed to a greater distance from the paper, the two black lines continued to be nearly of the same breadth, and the same degree of obscurity; but the penumbra in the middle grew lighter, and its breadth diminished, so that the two dark lines at the extremity of the shadow approached one another, till at the distance of 60 inches, they coincided, and the penumbra in the middle entirely vanished. At a still greater distance a faint penumbra was visible; but it was ill defined, and grew broader as the cylinder was removed farther off, but was sensible at a very great distance.

Besides the black and dark shadow which the cylinder formed near the opaque body, a narrow and faint penumbra was seen on the outside of the dark shadow. And on the outside of this there was a tract more strongly illuminated than the rest of the paper.

The breadth of the external penumbra increased with the distance of the shadow from the cylinder, and the breadth of the tract of light on the outside of it was also enlarged; but its splendour diminished with the distance.

He repeated these experiments with three other cylinders of different dimensions; and from all of them he inferred, that every opaque cylindrical body, exposed to the light of the sun, makes a shadow which is black and dark to the distance of 38 to 45 diameters of the cylinder which forms it; and that, at a greater distance, the middle part begins to be illuminated in the manner described above.

In explaining these appearances, Maraldi supposes that

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that the light which diluted the middle part of the shadow was occasioned by the inflection of the rays, which, bending inwards on their near approach to the body, did at a certain distance enlighten all the shadow, except the edges, which were left undisturbed. At the same time other rays were deflected from the body, and formed a strong light on the outside of the shadow, and which might at the same time contribute to dilute the outer shadow, though he supposed that penumbra to be occasioned principally by that part of the paper not being enlightened, except by a part of the sun's disk only, according to the known principles of optics.

54 Concerning those of globes.

The same experiments he made with globes of several diameters; but he found, that the shadows of the globes were not visible beyond 15 of their diameters; which he thought was owing to the light being inflected on every side of a globe, and consequently in such a quantity as to disperse the shadows sooner than in the case of the cylinders.

In repeating the experiments of Grimaldi and Newton, he observed that, besides the enlarged shadow of a hair, a fine needle, &c. the bright gleam of light that bordered it, and the three coloured fringes next to this enlightened part, when the shadow was at a considerable distance from the hair, the dark central shadow was divided in the middle by a mixture of light; and that it was not of the same density, except when it was very near the hair.

A bristle, at the distance of nine feet from the hole, made a shadow, which, being received at five or six feet from the object, he observed to consist of several streaks of light and shade. The middle part was a faint shadow, or rather a kind of penumbra, bordered by a darker shadow, and after that by a narrower penumbra; next to which was a light streak broader than the dark part, and next to the streak of light, the red, violet, and blue colours were seen as in the shadow of the hair.

55 Experiments concerning the shadows of plates.

A plate, two inches long, and about half a line broad, being fixed perpendicularly to the rays, at the distance of nine feet from the hole, a faint light was seen uniformly dispersed over the shadow, when it was received perpendicularly to it, and very near. The shadow of the same plate, received at the distance of two feet and a half, was divided into four narrow black streaks, separated by small lighter intervals equal to them. The boundaries of this shadow on each side had a penumbra, which was terminated by a very strong light, next to which were the coloured streaks of red, violet, and blue, as before. This is represented in Plate CCLXXVI. fig. 4. Fig. 4.

The shadow of the same plate, at $4\frac{1}{2}$ feet distance from it, was divided into two black streaks only, the two outermost having disappeared, as in fig. 5.; but these two black streaks which remained were broader than before, and separated by a lighter shade, twice as broad as one of the former black streaks, when the shadow was taken at $2\frac{1}{2}$ feet. This penumbra in the middle had a tinge of red. After the two black streaks there appeared a pretty strong penumbra, terminated by the two streaks of light, which were now broad and splendid, after which followed the coloured streaks. Fig. 5.

A second plate, 2 inches long and a line broad, being placed 14 feet from the hole, its shadow was received perpendicularly very near the plate, and was found to be illuminated by a faint light, equally dispersed, as in the case of the preceding plate. But being received at the distance of 13 feet from the plate, six small black streaks began to be visible, as in fig. 6. At 17 feet the black streaks were broader, more distinct, and more separated from the streaks that were less dark. At 42 feet, only two black streaks were seen in the middle of the penumbra, as in fig. 7. This middle penumbra between the two black streaks was tinged with red. Next to the black streaks there always appeared the streaks of light, which were broad, and the coloured streaks next to them. At the distance of 72 feet, the appearances were the same as in the former situation, except that the two black streaks were broader, and the interval between them, occupied by the penumbra, was broader also, and tinged with a deeper red. With plates from $\frac{1}{4}$ line to 2 lines broad, he could not observe any of the streaks of light, though the shadows were in some cases 56 feet from them. Fig. 6. Fig. 7.

The extraordinary size of the shadows of small substances M. Maraldi thought to be occasioned by the shadow from the enlightened part of the sky, added to that which was made by the light of the sun, and also to a vortex occasioned by the circulation of the inflected light behind the object.

Maraldi having made the preceding experiments upon single long substances, placed two of them so as to cross one another in a beam of the sun's light. The shadows of two hairs placed in this manner, and received at some distance from them, appeared to be painted reciprocally one upon the other, so that the obscure part of one of them was visible upon the obscure part of the other. The streaks of light also crossed one another, and the coloured streaks did the same.

He also placed in the rays of the sun a bristle and a plate of iron a line thick, so that they crossed one another obliquely; and when their shadows were received at the same distance, the light and dark streaks of the shadow of the bristle were visible so far as the middle of the shadow of the plate on the side of the acute angle, but not on the side of the obtuse angle, whether the bristle or the plate were placed next to the rays. The plate made a shadow sufficiently dark, divided into six black streaks; and these were again divided by as many light ones equal to them; and yet all the streaks belonging to the shadow of the bristle were visible upon it, as in fig. 8. To explain this appearance, he supposed that the rays of the sun glided a little along the bristle, so as to enlighten part of that which was behind the plate. But this seems to be an arbitrary and improbable supposition. Fig. 8.

M. Maraldi also placed small globes in the solar light, admitted through a small aperture, and compared their shadows with those of the long substances, as he had done in the day light, and the appearances were still similar. It was evident, that there was much more light in the shadows of the globes than in those of the cylinders, not only when they were both of an equal diameter, but when that of the globe was larger than that of the cylinder, and the shadows of both the bodies were received at the same distance. He also observed, that he could perceive no difference of light in the shadows of

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of the plates which were a little more than one line broad, though they were received at the distance of 72 feet; but he could observe a difference of shades in those of the globes, taken at the same distance, though they were $2\frac{1}{4}$ lines in diameter.

In order to explain the colours at the edges of these shadows, he threw some of the shadows upon others.

56 Experiments with a mixture of coloured shadows.

He threw the gleam of light, which always intervened between the colours and the darker part of the shadow, upon different parts of other shadows; and observed, that, when it fell upon the exterior penumbra made by another needle, it produced a beautiful sky blue colour, almost like that which was produced by two blue colours thrown together. When the same gleam of light fell upon the deeper shadow in the middle, it produced a red colour.

He placed two plates of iron, each three or four lines broad, at a very small distance: and having placed them in the rays of the sun, and received their shadows at the distance of 15 or 20 feet from them, he saw no light between them but a continued shadow, in the middle of which were some parallel streaks of a lively purple, separated by other black streaks; but between them there were other streaks, both of a very faint green, and also of a pale yellow.

57 M. Mairan's theory.

The subject of inflection was next investigated by M. Mairan: but he only endeavoured to explain the facts which were known, by the hypothesis of an atmosphere surrounding all bodies; and consequently making two reflections and refractions of the light that falls upon them, one at the surface of the atmosphere, and the other at that of the body. This atmosphere he supposed to be of a variable density and refractive power, like the atmosphere.

58 Discoveries of M. Du Tour.

M. Du Tour thought the variable atmosphere superfluous, and attempted to account for all the phenomena by an atmosphere of an uniform density, and of a less refractive power than the air surrounding all bodies.

Only three fringes had been observed by preceding authors, but M. Du Tour was accidentally led to observe a greater number of them, and adopted from Grimaldi the following ingenious method of making them all appear very distinct.

Plate CCCLXXVI. fig. 9.

He took a circular board ABED, (fig. 9.) 13 inches in diameter, the surface of which was black, except at the edge, where there was a ring of white paper about three lines broad, in order to trace the circumference of a circle, divided into 360 degrees, beginning at the point A, and reckoning 180 degrees on each hand to the point E; B and D being each of them placed at 90 degrees. A slip of parchment 3 inches broad, and disposed in the form of a hoop, was fastened round the board, and pierced at the point E with a square hole, each side being 4 or 5 lines, in order to introduce a ray of the sun's light; and in the centre of the board C, he fixed a perpendicular pin about $\frac{1}{5}$ of a line in diameter.

This hoop being so placed, that a ray of light entering the chamber, through a vertical cleft of $2\frac{1}{3}$ lines in length, and about as wide as the diameter of the pin, went through the hole at E, and passing parallel to the plane of the board, projected the image of the sun and the shadow of the pin at A. In these circumstances he observed, 1. That quite round the concave surface of this hoop, there were a multitude of coloured streaks; but that the space m A n, of about 18 degrees, the middle of which was occupied by the image of the sun, was covered with a faint light only. 2. The order of the colours in these streaks was generally such that the most refrangible rays were the nearest to the incident ray ECA; so that, beginning from the point A, the violet was the first and the red the last colour in each of the streaks. In some of them, however, the colours were disposed in a contrary order. 3. The image of the sun, projected on each side of the point A, was divided by the shadow of the pin, which was bordered by two luminous streaks. 4. The coloured streaks were narrower in some parts of the hoop than others, and generally decreased in breadth in receding from the point A. 5. Among these coloured streaks, there were sometimes others which were white, 1 or $1\frac{1}{2}$ lines in breadth, which were generally bordered on both sides by a streak of orange colour.

From this experiment he thought it evident, that the rays which passed beyond the pin were not the only ones that were decomposed, for that those which were reflected from the pin were decomposed also, whence he concluded that they must have undergone some refraction. He also imagined that those which went beyond the pin suffered a reflection, so that they were all affected in a similar manner.

In order to give some idea of his hypothesis, M. Du Tour shows that the ray a b, fig. 10. after being refracted at b, reflected at r and u, and again refracted at s and t, will be divided into its proper colours; the least refrangible or the red rays issuing at x, and the most refrangible or violet at y. Those streaks in which the colours appear in a contrary order he thinks are to be ascribed to inequalities in the surface of the pin.

The coloured streaks nearest the shadow of the pin, he supposes to be formed by those rays which, entering the atmosphere, do not fall upon the pin; and, without any reflection, are only refracted at their entering and leaving the atmosphere, as at b and r u, fig. 11. In this case, the red or least refrangible rays will issue at r, and the violet at u.

To distinguish the rays which fell upon the hoop in any particular direction, from those that came in any other, he made an opening in the hoop, as at P, fig. 9. by which means he could, with advantage, and at any distance from the centre, observe those rays unmixed with any other.

To account for the coloured streaks being larger next the shadow of the pin, and growing narrower to the place where the light was admitted, he shows, by fig. 12. that the rays a b are farther separated by both the refractions than the rays c d.

Sometimes M. Du Tour observed, that the broader streaks were not disposed in this regular order; but then he found, that by turning the pin they changed their places, so that this circumstance must have been an accidental irregularity in the surface of the pin.

The white streaks mixed with the coloured ones he ascribes to small cavities in the surface of the pin; for they also changed their places when the pin was turned upon its axis.

He also found, that bodies of various kinds, and of different sizes, always produced fringes of the same dimensions.

Exposing two pieces of paper in the beam of light, so that part of it passed between two planes formed by them,

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them, M. du Tour observed, that the edges of this light were bordered with two orange streaks. To account for them, he supposes, that the more refrangible of the rays which enter at *b* are so refracted, that they do not reach the surface of the body at R: so that the red and orange light may be reflected from thence in the direction *d* M, where the orange streaks will be formed; and, for the same reason, another streak of orange will be formed at *m*, by the rays which enter the atmosphere on the other side of the chink. In a similar manner he accounts for the orange fringes at the borders of the white streaks, in the experiment of the hoop. He supposes, that the blue rays, which are not reflected at R, pass on to I; and that these rays form the blue tinge observable in the shadows of some bodies. This, however, is mere trifling.

Fig. 13.

60
This hypothesis useless and ill-founded.

We may here make a general observation, applicable to all the attempts of philosophers to explain these phenomena by atmospheres. These attempts gave no explanation whatever of the physical cause of the phenomena. A phenomenon is some individual fact or event in nature. We are said to explain it, when we point out the general fact in which it is comprehended, and show the manner in which it is so comprehended, or the particular modification of the general fact. Philosophy resembles natural history, having for its subject the *events* of nature; and its investigations are nothing but the classification of these events, or the arrangement of them under the general facts of which they are individual instances. In the present instance there is no general fact referred to. The atmosphere is a mere gratuitous supposition; and all that is done is to show a resemblance between the phenomena of inflection of light to what would be the phenomena were bodies surrounded with such atmospheres; and even in this point of view, the discussions of Marian and Du Tour are extremely deficient. They have been satisfied with very vague resemblances to a fact observed in one single instance, namely, the refraction of light through the atmosphere of this globe.

The attempt is to explain how light is turned out of its direction by passing near the surface of bodies. This indicates the action of forces in a direction transverse to that of the light. Newton took the right road of investigation, by taking the phenomenon in its original simplicity, and attending merely to this, that the rays are deflected from their former course; and the sole aim of his investigation was to discover the laws, or the more general facts in this deflection. He deduced from the phenomena, that some rays are more deflected than others, and endeavoured to determine in what rays the deflections are most remarkable: and no experiment of M. du Tour has shown that he was mistaken in his modified assertion, that those rays are most inflected which pass nearest to the body. We say modified assertion; for Newton points out with great sagacity many instances of alternate fits of inflection and deflection; and takes it for granted, that the law of continuity is observed in these phenomena, and that the change of inflection into deflection is gradual.

But these analogical discussions are eminently deficient in another respect: They are held out as mechanical explanations of the changes of motion observed in rays of light. When it shall be shewn, that these are precisely such as are observed in refracting atmospheres, nothing is done towards deciding the original question; for the action of refracting atmospheres presents it in all its difficulties, and we must still ask how do these atmospheres produce this effect? No advance whatever is gained in science by thrusting in this hypothetical atmosphere; and Newton did wisely in attaching himself to the simple fact: and he thus gives us another step in science, by showing us a fact unknown before, viz. that the action of bodies on light is not confined to transparent bodies. He adds another general fact to our former stock, *that light as well as other matter is acted on at a distance;* and thus he made a very important deduction, *that reflection, refraction, and inflection, are probably brought about by the same forces.*

61
Reflection, refraction, and inflection probably produced by the same forces.

62
Objects sometimes magnified by inflection.

M. Le Cat has well explained a phenomenon of vision depending upon the inflection of light, which shows, that, in some cases objects by this means appear magnified. Looking at a distant steeple, when a wire, of a less diameter than the pupil of his eye, was held near to it, and drawing it several times betwixt his eye and that object, he found, that, every time the wire passed before his pupil, the steeple seemed to change its place, and some hills beyond the steeple appeared to have the same motion, just as if a lens had been drawn betwixt his eye and them. He found also, that there was a position of the wire in which the steeple seemed not to have any motion, when the wire was passed before his eye; and in this case the steeple appeared less distinct and magnified. He then placed his eye in such a manner with respect to the steeple, that the rays of light by which he saw it must come very close to the edge of a window; where he had placed himself to make his observations; and passing the wire before his eyes, he observed, that when it was in the visual axis, the steeple appeared nearer to the window, on whichever side the wire was made to approach. He repeated this experiment, and always, with the same result, the object being by this means magnified, and nearly doubled.

Plate CCCLXXVI. fig. 14.

This phenomenon he explains by fig. 14. in which B represents the eye, A the steeple, and C a section of the wire. The black lines express the cone of light by which the natural image of the steeple A is formed, and which is much narrower than the diameter of the wire C; but the dotted lines include not only that cone of light, stopped and turned out of its course by the wire, but also more distant rays inflected by the wire, and thereby thrown more converging into the pupil; just as would have been the effect of the interposition of a lens between the eye and the object.

Sect. IV. *Discoveries concerning Vision.*

63
Discoveries of Maurolycus, Kepler, &c. concerning vision.

Maurolycus was the first who demonstrated that the crystalline humour of the eye is a lens which collects the light issuing from external objects, and converges them upon the retina. He did not, however, seem to be aware that an image of every visible object was thus formed upon the retina, though this seems hardly to have been a step beyond the discovery he had made. Montucla conjectures, that he was prevented from mentioning this part of the discovery by the difficulty of accounting for the upright appearance of objects. This discovery was made by Kepler; but he, too, was much puzzled with the inversion of the image upon the retina.

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na. The rectification of these images, he says, is the business of the mind; which, when it perceives an impression on the lower part of the retina, considers it as made by rays proceeding from the higher parts of objects; tracing the rays back to the pupil, where they cross one another. This is the true explanation of the difficulty, and is exactly the same as that which was lately given by Dr Reid.

64 Discoveries of Scheiner.

These discoveries concerning vision were completed by Scheiner. For, in cutting away the coats of the back part of the eyes of sheep and oxen, and presenting several objects before them, he saw their images distinctly painted upon the retina. He did the same with the human eye, and exhibited this experiment at Rome in 1625.

Scheiner took a good deal of pains to ascertain the density and refractive power of all the humours of the eye, by comparing their magnifying power with that of water or glass in the same form and circumstances. The result of his inquiries was, that the aqueous humour does not differ much from water in this respect, nor the crystalline from glass; and that the vitreous humour is a medium between both. He also traces the progress of the rays of light through all the humours; and after discussing every possible hypothesis concerning the seat of vision, he demonstrates that it is in the retina, and shows that this was the opinion of Alhazen, Vitellio, Kepler, and all the most eminent philosophers. He advances many reasons for this hypothesis; answers many objections to it; and, by a variety of arguments, refutes the opinion that the seat of vision is in the crystalline lens.

65 Discoveries of Descartes.

The subject of vision occupied the attention of Descartes. He explains the methods of judging of the magnitudes, situations, and distances, of objects, by the direction of the optic axes; comparing it to a blind man's judging of the size and distance of an object, by feeling it with two sticks of a known length, when the hands in which he holds them are at a known distance from each other. He also remarks, that having been accustomed to judge of the situation of objects by their images falling on a particular part of the eye; if by any distortion of the eye they fall on a different place, we are apt to mistake their situation, or imagine one object to be two, in the same way as we imagine one stick to be two, when it is placed between two contiguous fingers laid across one another. The direction of the optic axes, he says, will not serve us beyond 15 or 20 feet, and the change of form of the crystalline not more than three or four feet. For he imagined that the eye conforms itself to different distances by a change in the curvature of the crystalline, which he supposed to be a muscle, the tendons of it being the ciliary processes. In another place, he says, that the change in the conformation of the eye is of no use to us for the purpose of judging of distances beyond four or five feet, and the angle of the optic axes not more than 100 or 200 feet: for this reason, he says, that the sun and moon are conceived to be much more nearly of the same size than they are in reality. White and luminous objects, he observes, appear larger than others, and also the parts contiguous to those on which the rays actually impinge; and for the same reason, if the objects be small, and placed at a great distance, they will always appear round, the figure of the angles disappearing.

66 Berkeley's theory of vision.

The celebrated Dr Berkeley, bishop of Cloyne, published, in 1709, An Essay towards a New Theory of Vision, in which he solves many difficulties. He does not admit that it is by means of those lines and angles, which are useful in explaining the theory of optics, that different distances are estimated by the sense of sight; neither does he think that the mere direction of the optic axes, or the greater or less divergency of the rays of light, are sufficient for this purpose. "I appeal (says he) to experience, whether any one computes distance by the bigness of the angle made by the meeting of the two *optic axes*; or whether he ever thinks of the greater or less divergency of the rays which arrive from any point to his pupil: Nay, whether it be not perfectly impossible for him to perceive, by sense, the various angles wherewith the rays according to their greater or lesser divergency fell upon his eye." That there is a necessary connexion between these various angles, &c. and different degrees of distance, and that this connexion is known to every person skilled in optics, he readily acknowledges; but "in vain (he observes) shall mathematicians tell me, that I *perceive* certain *lines* and *angles*, which introduce into my mind the various notions of *distance*, so long as I am conscious of no such thing." He maintains that distance, magnitude, and even figure, are the objects of immediate perception only by the sense of touch; and that when we judge of them by sight, it is from different sensations felt in the eye, which experience has taught us to be the consequence of viewing objects of greater or less magnitude, of different figures, and at different distances. These sensations, with the respective distances, figures, and magnitudes by which they are occasioned, become so closely associated in the mind long before the period of distinct recollection, that the presence of the one instantly suggests the other; and we attribute to the sense of sight those notions which are acquired by the sense of touch, and of which certain *visual* sensations are merely the signs or symbols, just as words are the symbols of ideas. Upon these principles he accounts for single and erect vision. Subsequent writers have made considerable discoveries in the theory of vision; and among them there is hardly any one to whom this branch of science is so much indebted as to Dr Reid, and Dr Wells, whose reasonings we shall afterwards have occasion to detail.

Sect. V. *Of Optical Instruments.*

67 Invention of spectacles.

Glass globes, and specula, seem to have been the only optical instruments known to the ancients. Alhazen gave the first hint of the invention of spectacles. From the writings of this author, together with the observations of Roger Bacon, it is not improbable that some monks gradually hit upon the construction of spectacles; to which Bacon's lesser segment was a nearer approach than Alhazen's larger one.

It is certain that spectacles were well known in the 13th century, and not long before. It is said that Alexander Spina, a native of Pisa, who died in 1313, happened to see a pair of spectacles in the hands of a person who would not explain them to him; but that he succeeded in making a pair for himself, and immediately made the construction public. It is also inscribed on the tomb of Salvinus Armatus, a nobleman of Florence, who died 1317, that he was the inventor of spectacles.

Though

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68 Descartes's account of the invention of telescopes.

Though both convex and concave lenses were sufficiently common, yet no attempt was made to combine them into a telescope till the end of the 16th century. Descartes considers James Metius as the first constructor of the telescope: and says, that as he was amusing himself with mirrors and burning glasses, he thought of looking through two of his lenses at a time; and that happening to take one that was convex and another that was concave, and happening also to hit upon a pretty good adjustment of them, he found, that by looking through them, distant objects appeared very large and distinct. In fact, without knowing it, he had made a telescope.

69 Other accounts.

Other persons say, that this great discovery was first made by John Lippersheim, a spectacle-maker at Middleburgh, or rather by his children; who were diverting themselves with looking through two glasses at a time, and placing them at different distances from one another. But Borellus, the author of a book entitled *De vero telescopii inventore*, gives this honour to Zacharius Joannides, i. e. Jansen, another spectacle-maker at the same place, who made the first telescope in 1590.

This ingenious mechanic had no sooner found the arrangement of glasses that magnified distant objects, than he enclosed them in a tube, and ran with his instrument to Prince Maurice; who, immediately conceiving that it might be useful in his wars, desired the author to keep it a secret. But this was found impossible; and several persons in that city immediately applied themselves to the making and selling of telescopes. One of the most distinguished of these was Hans Laprey, called *Lippersheim* by Sirturus. Some person in Holland being very early supplied by him with a telescope, he passed with many for the inventor; but both Metius above mentioned, and Cornelius Drebell of Alcmaar, in Holland, applied to the inventor himself in 1620; as also did Galileo, and many others. The first telescope made by Jansen did not exceed 15 or 16 inches in length; but Sirturus, who says that he had seen it, and made use of it, thought it the best that he had ever examined.

70 The first telescope an exceedingly good one.

Jansen directing his telescope to celestial objects, distinctly viewed the spots on the surface of the moon; and discovered many new stars, particularly seven pretty considerable ones in the Great Bear. His son, Joannes Zacharias, observed the lucid circle near the limb of the moon, from whence several bright rays seem to dart in different directions: and he says, that the full moon, viewed through this instrument, did not appear flat, but was evidently globular. Jupiter appeared round, and rather spherical; and sometimes he perceived two, sometimes three, and at other times even four small stars, a little above or below him; and, as far as he could observe, they performed revolutions round him.

71 A telescope made by Galileo without seeing one.

There are some who say that Galileo was the inventor of telescopes; but he himself acknowledges, that he first heard of the instrument from a German; but, that being informed of nothing more than the effects of it, first by common report, and a few days after by a French nobleman, J. Badovere, at Paris, he himself discovered the construction, by considering the nature of refraction: and thus he had much more real merit than the inventor himself.

About April or May, in 1609, it was reported at Venice, where Galileo (who was professor of mathematics in the university of Padua) then happened to be, that a Dutchman had presented to Count Maurice of Nassau, a certain optical instrument, by means of which, distant objects appeared as if they were near; but no farther account of the discovery had reached that place, though this was near 20 years after the first discovery of the telescope. Struck, however, with this account, Galileo returned to Padua, considering what kind of an instrument this must be. The night following, the construction occurred to him; and the day after, putting the parts of the instrument together, as he had previously conceived it; and notwithstanding the imperfection of the glasses that he could then procure, the effect answered his expectations, as he presently acquainted his friends at Venice, where, from several eminences, he showed to some of the principal senators of that republic a variety of distant objects, to their very great astonishment. When he had made farther improvements in the instrument, he made a present of one of them to the Doge, Leonardo Donati, and at the same time to all the senate of Venice; giving along with it a written paper, in which he explained the structure and wonderful uses that might be made of the instrument both by land and sea. In return for so noble an entertainment, the republic, on the 25th of August, in the same year, more than tripled his salary as professor.

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72 Account of his discoveries.

Galileo having amused himself for some time with the view of terrestrial objects, at length directed his tube towards the heavens; and found, that the surface of the moon was diversified with hills and valleys, like the earth. He found that the milky way and *nebulæ* consisted of a collection of fixed stars, which on account either of their vast distance, or extreme smallness, were invisible to the naked eye. He also discovered innumerable fixed stars dispersed over the face of the heavens, which had been unknown to the ancients; and examining Jupiter, he found him attended by four stars, which, at certain periods, performed revolutions round him.

This discovery he made in January 1610, new style; and continuing his observations the whole of February following, he published, in the beginning of March, an account of all his discoveries, in his *Nuncius Sidereus*, printed at Venice.

The extraordinary discoveries contained in the Nuncius Sidereus, which was immediately reprinted both in Germany and France, were the cause of much debate among the philosophers of that time; many of whom could not give any credit to Galileo's account, while others endeavoured to decry his discoveries as nothing more than mere illusions.

In the beginning of July, 1610, Galileo being still at Padua, and getting an imperfect view of Saturn's ring, imagined that that planet consisted of three parts; and therefore, in the account which he gave of this discovery to his friends, he calls it *planetam tergeminam*.

Whilst he was still at Padua, he observed some spots on the face of the sun: but he did not choose, at that time, to publish his discovery; partly for fear of incurring more of the hatred of many obstinate Peripatetics; and partly in order to make more exact observations on this remarkable phenomenon, as well as to form some conjecture concerning the probable cause of it. He therefore contented himself with communicating his observations to some of his friends at Padua and Venice,

among

among whom we find the name of Father Paul. This delay, however, was the cause of this discovery being contested with him by the famous Scheiner, who likewise made the same observation in October 1611, and we suppose had anticipated Galileo in the publication of it.

In November following Galileo was satisfied, that, from the September preceding, Venus had been continually increasing in bulk, and that she changed her phases like the moon. About the end of March 1611, he went to Rome, where he gratified the cardinals, and all the principal nobility, with a view of the new wonders which he had discovered in the heavens.

Twenty-nine years Galileo enjoyed the use of his telescope, continually enriching astronomy with his observations: but by too close an application to that instrument, and the detriment he received from the nocturnal air, his eyes grew gradually weaker, till in 1639 he became totally blind; a calamity which, however, neither broke his spirits, nor interrupted the course of his studies.

73 Account of his telescopes.

The first telescope that Galileo constructed magnified only three times; but presently after, he made another which magnified 18 times; and afterwards with great trouble and expence, he constructed one that magnified 33 times; and with this it was that he discovered the satellites of Jupiter and the spots of the sun.

74 The *rationale* of the instrument first discovered by Kepler.

The honour of explaining the rationale of the telescope is due to the celebrated Kepler. He made several discoveries relating to the nature of vision; and not only explained the theory of the telescope which he found in use, but also pointed out methods of constructing others of superior powers and more commodious application.

It was Kepler who first gave a clear explication of the effects of lenses, in converging and diverging the rays of a pencil of light. He showed, that a plano-convex lens makes rays that were parallel to its axis, to meet at the distance of the diameter of the sphere of convexity; but that if both sides of the lens be equally convex, the rays will have their focus at the distance of the radius of the circle, corresponding to that degree of convexity. He did not, however, investigate any rule for the foci of lenses unequally convex. He only says, in general, that they will fall somewhere in the middle, between the foci belonging to the two different degrees of convexity. We owe this investigation to Cavalieri, who laid down the following rule: As the sum of both the diameters is to one of them, so is the other to the distance of the focus.

75 General reason of the effects of telescopes.

The principal effects of telescopes depend upon these simple principles, viz. That objects appear larger in proportion to the angles which they subtend at the eye; and the effect is the same whether the pencils of rays, by which objects are visible to us, come directly from the objects themselves, or from any place nearer to the eye, where they may have been converged so as to form an image of the object; because they issue again from those points where there is no real substance, in certain directions, in the same manner as they did from the corresponding points in the objects themselves.

In fact, therefore, all that is effected by a telescope is, first, to make such an image of a distant object, by means of a lens or mirror; and then to give the eye some assistance for viewing that image as near as possible: so that the angle which it shall subtend at the eye, may be very large, compared with the angle which the object itself would subtend in the same situation. This is done by means of an eye-glass, which so refracts the pencils of rays, that they may afterwards be brought to their several foci by the humours of the eye. But if the eye was so formed as to be able to see the image with sufficient distinctness at the same distance without any eye-glass, it would appear to him as much magnified as it does to another person who makes use of a glass for that purpose, though he would not in all cases have so large a field of view.

If, instead of an eye-glass, an object be looked at through a small hole in a thin plate or piece of paper, held close to the eye, it may be viewed very near to the eye, and, at the same distance, the apparent magnitude of the object will be the same in both cases. For if the hole be so small as to admit but a single ray from every point of the object, these rays will fall upon the retina in as many other points, and make a distinct image. They are only pencils of rays, which have a sensible base, as the breadth of the pupil, that are capable, by their spreading on the retina, of producing an indistinct image. As very few rays, however, can be admitted through a small hole, there will seldom be light sufficient to view any object to advantage in this manner.

If no image be formed by the foci of the pencils without the eye, yet if, by the help of a concave eye-glass, the pencils of rays shall enter the pupil, just as they would have done from any place without the eye, the visual angle will be the same as if an image had actually been formed in that place. Objects will not appear inverted through this telescope, because the pencils which form the images of them, only cross one another once, viz at the object glass, as in natural vision they do in the pupil of the eye.

Such is the telescope that was first discovered and used by philosophers. The great inconvenience attending it is, that the field of view is exceedingly small. For since the pencils of rays enter the eye very much diverging from one another, but few of them can be intercepted by the pupil. This inconvenience increases with the magnifying power of the telescope; so that it is a matter of surprise how, with such an instrument, Galileo and others could have made such discoveries. No other telescope, however, than this, was so much as thought of for many years after the discovery. Descartes, who wrote 30 years after, mentions no others as actually constructed.

76 Galilean telescope more difficult of construction than others.

It is to the celebrated Kepler that we are indebted for the construction of what we now call the *astronomical telescope*. The *rationale* of this instrument is explained, and the advantages of it are clearly pointed out, by this philosopher, in his Catoptrics; but, what is very surprising, he never actually reduced his theory into practice. Montucla conjectures, that the reason why he did not make trial of this new construction was, his not being aware of the great increase of the field of view; so that being engaged in other pursuits, he might not think it of much consequence to take any pains about the construction of an instrument, which could do little more than answer the same purpose with those which he already possessed. He must also have foreseen, that the length,

77 Telescopes improved by Kepler.

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length of this telescope must have been greater in proportion to its magnifying power, so that it might appear to him to be upon the whole not quite so good a construction as the former.

78 His method first put in practice by Scheiner.

The first person who actually made an instrument of Kepler's construction was Father Scheiner, who has given a description of it in his *Rosa Ursina*, published in 1630. If, says he, you insert two similar lenses in a tube, and place your eye at a convenient distance, you will see all terrestrial objects, inverted, indeed, but magnified, and very distinct, with a considerable extent of view. He afterwards subjoins an account of a telescope of a different construction, with two convex eye-glasses, which again reverses the images, and makes them appear in their natural position. This disposition of the lenses had also been pointed out by Kepler, but had not been reduced to practice. This construction, however, answered the end very imperfectly; and Father Rheita presently after discovered a better construction, using three eye-glasses instead of two.

The only difference between the Galilean and the astronomical telescope is, that the pencils by which the extremities of any object are seen in this case, enter the eye diverging; whereas, in the other they enter it converging; but if the sphere of concavity in the eye-glass of the Galilean telescope be equal to the sphere of convexity in the eye-glass of another telescope, their magnifying power will be the same. The concave eye-glass, however, being placed between the object-glass and its focus, the Galilean telescope will be shorter than the other, by twice the focal length of the eye-glass. Consequently, if the length of the telescopes be the same, the Galilean will have the greater magnifying power.

79 Huygens improves the telescopes of Scheiner and Rheita.

Huygens was particularly eminent for his systematic knowledge of optics, and is the author of the chief improvements which have been made on all the dioptrical instruments till the discovery of the achromatic telescope. He was well acquainted with the theory of aberration arising from the spherical figure of the glasses, and has shown several ingenious methods of diminishing them by proper constructions of the eye-pieces. He first pointed out the advantages of two eye glasses in the astronomical telescope and double microscope, and gave rules for this construction, which both enlarges the field and shortens the instrument. Mr Dollond adapted his construction to the terrestrial telescope of De Rheita; and his five eye-glasses are nothing but the Huygenian eye-piece doubled. This construction has been too hastily given up by the artists of the present day for another, also of Mr Dollond's, of four glasses.

80 Binocular telescope.

The same Father Rheita, to whom we are indebted for the construction of a telescope for land objects, invented a binocular telescope, which Father Cherubin, of Orleans, afterwards endeavoured to bring into use. It consists of two telescopes fastened together, pointed to the same object. When this instrument is well fixed, the object appears larger, and nearer to the eye, when it is seen through both the telescopes, than through one of them only, though they have the very same magnifying power. But this is only an illusion, occasioned by the stronger impression made upon the eye, by two equal images, equally illuminated. This advantage, however, is counterbalanced by the inconvenience attending the use of it.

81 Telescopes of Campani and Divini.

The first who distinguished themselves in grinding telescopic glasses were two Italians, Eustachio Divini at Rome, and Campani at Bologna, whose fame was much superior to that of Divini, or that of any other person of his time; though Divini himself pretended, that, in all the trials that were made with their glasses, his, of a greater focal length, performed better than those of Campani, and that his rival was not willing to try them with equal eye-glasses. It is generally supposed, however, that Campani really excelled Divini, both in the goodness and the focal length of his object-glasses. It was with telescopes made by Campani that Cassini discovered the nearest satellites of Saturn. They were made by the express order of Louis XIV. and were of 86, 100, and 136 Paris feet in focal length.

Campani sold his lenses for a great price, and took every possible method to keep his art of making them secret. His laboratory was inaccessible, till after his death; when it was purchased by Pope Benedict XIV. who presented it to the academy called the *Institute*, established in that city; and by the account which M. Fougeroux has given of what he could discover from it, we learn, that (except a machine, which M. Campani constructed, to work the basons on which he ground his glasses) the goodness of his lenses depended upon the clearness of his glass, his Venetian tripoli, the paper with which he polished them, and his great skill and address as a workman. It was also the general opinion that he owed much of his reputation to the secrecy and air of mystery which he affected; and that he made a great number of object-glasses which he rejected, showing only those that were very good. He made few lenses of a very great focal distance; and having the misfortune to break one of 141 feet in two pieces, he took incredible pains to join the two parts together, which he did at length so effectually, that it was used as if it had been entire; but it is not probable that he would have taken so much pains about it, if, as he pretended, he could very easily have made another as good.

Sir Paul Neille, Dr Hooke says, made telescopes of 36 feet, pretty good, and one of 50, but not of proportional goodness. Afterwards Mr Reive, and then Mr Cox, who were the most celebrated in England as grinders of optic glasses, made some good instruments of 50 and 60 feet focal length, and Mr Cox made one of 100.

82. Extraordinary object-glass made by M. Auzout.

These, and all other telescopes, were far exceeded by an object glass of 600 feet focus made by M. Auzout; but he was never able to manage it. Hartsocker is even said to have made some of a still greater focal length; but this ingenious mechanic, finding it impossible to make use of object-glasses the focal distance of which was much less than this, when they were enclosed in a tube, contrived a method of using them without a tube, by fixing them at the top of a tree, a high wall, or the roof of a house.

83. Telescopes used without tubes.

Mr Huygens, who was also an excellent mechanic, made considerable improvements on this contrivance of Hartsocker's. He placed the object-glass at the top of a long pole, have previously enclosed it in a short tube, which was made to turn in all directions by means of a ball and socket. The axis of this tube he could command with a fine silken string, so as to bring it into a line with the axis of another short tube which he held in his hand, and which contained the eye-glass. In this method he could make use of object-glasses of the greatest

History. greatest magnifying power, at whatever altitude his object was, and even in the zenith, provided his pole was as long as his telescope; and to adapt it to the view of objects of different altitudes, he had a contrivance, by which he could raise or depress at pleasure, a stage that supported his object-glass.

M. de la Hire made some improvements in this method of managing the object-glass, by fixing it in the centre of a board, and not in a tube; but as it is not probable that this method will ever be made use of, since the discovery of both reflecting and achromatic telescopes, which are now brought to great perfection, and have even micrometers adapted to them, we shall not describe the apparatus minutely, but shall only give a drawing of M. Huygen's pole, with a short explanation. In fig. 1. *a* represents a pulley, by the help of which a stage *c*, *d*, *e*, *f*, (that supports the object-glass *k*, and the apparatus belonging to it), may be raised higher or lower at pleasure, the whole being counterpoised by the weight *h*, fastened to a string *g*. *n*, is a weight, by means of which the centre of gravity of the apparatus belonging to the object-glass is kept in the ball and socket, so that it may be easily managed by the string *l u*, and its axis brought into a line with the eye-glass at *o*. When it was very dark, M. Huygens was obliged to make his object-glass visible by a lantern, *y*, so constructed as to throw up to it the rays of light in a parallel direction.

Plate CCCLXXVII. fig. 1.

84
Of the apertures of refracting telescopes.

Before leaving this subject, it must be observed, that M. Auzout, in a paper delivered to the Royal Society, observed, that the apertures which the object-glasses of refracting telescopes can bear with distinctness, are in the subduplicate ratio of their lengths; and upon this supposition he drew up a table of the apertures of object-glasses of a great variety of focal lengths, from 4 inches to 400 feet. Upon this occasion, however, Dr Hooke observed, that the same glass will bear a greater or less aperture, according to the less or greater light of the object.

But all these improvements were diminished in value by the discovery of the *reflecting telescope*. For a refracting telescope, even of 1000 feet focus, supposing it possible to be made use of, could not be made to magnify with distinctness more than 1000 times; whereas a reflecting telescope, not exceeding 9 or 10 feet will magnify 1200 times.

85
History of the reflecting telescope.

"It must be acknowledged, says Dr Smith, that Mr James Gregory of Aberdeen was the first inventor of the reflecting telescope; but his construction is quite different from Sir Isaac Newton's, and not nearly so advantageous."

According to Dr Pringle, Mersennus was the man who entertained the first thought of a reflector. He certainly proposed a telescope with specula to the celebrated Descartes many years before Gregory's invention, though indeed in a manner so very unsatisfactory, that Descartes was so far from approving the proposal, that he endeavoured to convince Mersennus of its fallacy. Dr Smith, it appears, had never perused the two letters of Descartes to Mersennus which relate to that subject.

Gregory, a young man of uncommon genius, was led to the invention, in trying to correct two imperfections of the common telescope: the first was its too great length, which made it less manageable; the second, the incorrectness of the image. Mathematicians had demonstrated, that a pencil of rays could not be collected in a single point by a spherical lens; and also, that the image transmitted by such a lens would be in some degree incurvated. These inconveniences he believed would be obviated by substituting for the object-glass a metallic speculum, of a parabolic figure, to receive the incident rays, and to reflect them towards a small speculum of the same metal; this again was to return the image to an eye-glass placed behind the great speculum, which for that purpose was to be perforated in its centre. This construction he published in 1663, in his *Optica Promota*. But as Gregory, by his own account, was endowed with no mechanical dexterity, nor could find any workman capable of constructing his instrument, he was obliged to give up the pursuit: and probably, had not some new discoveries been made in light and colours, a reflecting telescope would never more have been thought of.

At an early period of life, Newton had applied himself to the improvement of the telescope; but imagining that Gregory's specula were neither very necessary, nor likely to be executed, he began with prosecuting the views of Descartes, who aimed at making a more perfect image of an object, by grinding lenses, not to the figure of a sphere, but to that of one of the conic sections. Whilst he was thus employed, three years after Gregory's publication, he happened to examine the colours, formed by a prism, and having by means of that simple instrument discovered the different refrangibility of the rays of light, he then perceived that the errors of telescopes arising from that cause alone, were some hundred times greater than those which were occasioned by the spherical figure of lenses. This circumstance forced, as it were, Newton to fall into Gregory's track, and to turn his thoughts to reflectors. "The different refrangibility of the rays of light (says he in a letter to Mr Oldenburg, secretary to the Royal Society, dated Feb. 1672) made me take reflections into consideration; and finding them regular, so that the angle of reflection of all sorts of rays was equal to the angle of incidence, I understood that by their mediation optic instruments might be brought to any degree of perfection imaginable, providing a reflecting substance could be found which would polish as finely as glass, and reflect as much light as glass transmits, and the art of communicating to it a parabolical figure be also obtained. Amidst these thoughts I was forced from Cambridge by the intervening plague, and it was more than two years before I proceeded further."

It was towards the end of 1668, or in the beginning of the following year, when Newton being obliged to have recourse to reflectors, and not relying on any artificer for making his specula, set about the work himself, and early in the year 1672 completed two small reflecting telescopes. In these he ground the great speculum into the concave portion of a sphere; not but that he approved of the parabolic form proposed by Gregory, though he found himself unable to accomplish it. In the letter that accompanied one of these instruments which he presented to the Society, he writes, "that though he then despaired of performing that work (to wit, the parabolic figure of the great speculum) by geometrical rules, yet he doubted not but that the thing might in some measure be accomplished by mechanical devices."

Not less did the difficulty appear to find a metallic substance

substance that would be of a proper hardness, have the fewest pores, and receive the smoothest polish; a difficulty which he deemed almost unsurmountable, when he considered, that every irregularity in a reflecting surface would make the rays of light stray five or six times more out of their due course, than similar irregularities in a refracting one. In another letter, written soon after, he informs the secretary, "that he was very sensible that metal reflects less light than glass transmits; but as he had found some metallic substances more strongly reflective than others, to polish better, and to be freer from tarnishing than others, so he hoped that there might in time be found out some substances much freer from these inconveniences than any yet known." Newton therefore laboured till he found a composition that answered in some degree, and left it to those who should come after him to find a better. Huygens, one of the greatest geniuses of the age, and a distinguished improver of the refracting telescope, no sooner was informed by Mr Oldenburg of the discovery, than he wrote in answer, "that it was an admirable telescope; and that Mr Newton had well considered the advantage which a concave speculum had over convex glasses in collecting the parallel rays, which, according to his own calculation, was very great: Hence that Mr Newton could give a far greater aperture to that speculum than to an object glass of the same focal length, and consequently produce a much greater magnifying power than by an ordinary telescope. Besides, that by the reflector he avoided an inconvenience inseparable from object glasses, which was the obliquity of both their surfaces, which vitiated the refraction of the rays that pass towards the side of the glass: Again, That by the mere reflection of the metalline speculum there were not so many rays lost as in glasses, which reflected a considerable quantity by each of their surfaces, and besides intercepted many of them by the obscurity of their substance: That the main business would be to find a substance for this speculum that would bear as good a polish as glass. Lastly, He believed that Mr Newton had not omitted to consider the advantage which a parabolic speculum would have over a spherical one in this construction; but had despaired, as he himself had done, of working other surfaces than spherical ones with exactness." Huygens was not satisfied with thus expressing to the society his high approbation of the invention; but drew up a favourable account of the new telescope, which he published in the *Journal des Sçavans* for 1672, by which channel it was soon known over Europe.

Excepting an unsuccessful attempt which the society made, by employing an artificer to imitate the Newtonian construction, but upon a larger scale, and a disguised Gregorian telescope, set up by Cassegrain abroad as a rival to Newton's, no reflector was heard of for nearly half a century after. But when that period was elapsed, a reflecting telescope of the Newtonian form was at last produced by Mr Hadley, the inventor of the reflecting quadrant. The two telescopes which Newton had made were but six inches long; they were held in the hand for viewing objects, and in power were compared to a six feet refractor; whereas Hadley's was about five feet long, was provided with a well-contrived apparatus for managing it, and equalled in performance the famous aërial telescope of Huygens of 123 feet in length. Excepting the manner of making the specula, we have, in the Philosophical Transactions of 1723, a complete description, with a figure of this telescope, together with that of the machine for moving it; but, by a strange omission, Newton's name is not once mentioned in that paper, so that any person not acquainted with the history of the invention, and reading that account only, might be apt to conclude that Hadley had been the sole inventor.

The same celebrated artist, after finishing two telescopes of the Newtonian construction, accomplished a third of the Gregorian form; but, it would seem, less successfully. Mr Hadley spared no pains to instruct Mr Molyneux and the Reverend Dr Bradley; and when those gentlemen had made a sufficient proficiency in the art, being desirous that these telescopes should become more public, they liberally communicated to some of the principal instrument-makers of London the knowledge they had acquired from him.

Mr James Short, as early as the year 1734, had signalized himself at Edinburgh by the excellence of his telescopes. Mr Maclaurin wrote that year to Dr Jurin, "that Mr Short, who had begun with making glass specula, was then applying himself to improve the metallic; and that by taking care of the figure, he was enabled to give them larger apertures than others had done; and that upon the whole they surpassed in perfection all that he had seen of other workmen." He added, "that Mr Short's telescopes were all of the Gregorian construction; and that he had much improved that excellent invention." This character of excellence Mr Short maintained to the last; and with the more facility, as he was well acquainted with the theory of optics. It was supposed that he had fallen upon a method of giving the parabolic figure to his great speculum; a point of perfection that Gregory and Newton had despaired of attaining; and that Hadley had never, as far as we know, attempted. Mr Short indeed affirmed, that he had acquired that faculty, but never would tell by what peculiar means he effected it; so that the secret of working that configuration, whatever it was, died with that ingenious artist. Mr Mudge, however, has lately realized the expectation of Sir Isaac Newton, who, above 100 years ago, presaged that the public would one day possess a parabolic speculum, not accomplished by mathematical rules, but by mechanical devices.

This was a *desideratum*, but it was not the only want supplied by this gentleman: he has taught us likewise a better composition of metals for the specula, how to grind them better, and how to give them a finer polish; and this last part (namely the polish), he remarks, was the most difficult and essential of the whole operation. "In a word (says Sir John Pringle), I am of opinion, there is no optician in this great city (which hath been so long, and so justly renowned for ingenious and dexterous makers of every kind of mathematical instruments) so partial to his own abilities as not to acknowledge, that Mr Mudge has opened to them all some new and important lights, and has greatly improved the art of making reflecting telescopes."

86 Mr Edwards's improvements of the reflecting telescope.

The late reverend and ingenious John Edwards devoted much of his time to the improvement of reflecting telescopes, and brought them to such perfection, History. fection, that Dr Maskelyne, the astronomer royal, found telescopes constructed by him to surpass in brightness, and other respects, those of the same size made by the best artists in London. The chief excellence of his telescopes arises from the composition, which, from various trials on metals and semimetals, he discovered for the specula, and from the true parabolic figure, which, by long practice, he had found a method of giving them, preferable to any that was known before him. His directions for the composition of specula, and for casting, grinding, and polishing them, were published, by order of the commissioners of longitude, at the end of the Nautical Almanack for the year 1787. To the same almanack is also annexed his account of the cause and cure of the tremors which particularly affect reflecting telescopes more than refracting ones, together with remarks on these tremors by Dr Maskelyne.

87 Herschel's improvements.

But in constructing reflecting telescopes of extraordinary magnifying powers, Dr Herschel has displayed skill and ingenuity surpassing all his predecessors in this department of mechanics. He has made them from 7, 10, 20, to even 40 feet in length; and with instruments of these dimensions he is now employed in making discoveries in astronomy. Of the construction, magnifying powers, and the curious collection of machinery by which his 40 feet telescope is supported and moved from one part of the heavens to another, accounts will be given under the word TELESCOPE.

The greatest improvement in *refracting* telescopes hitherto made public is that of Mr Dollond, of which an account has already been given in a preceding section, in which his discoveries in the science of Optics were explained. But, besides the obligation we are under to him for correcting the aberration of the rays of light in the focus of object-glasses, he made another considerable improvement in telescopes, viz. by correcting, in a great measure, both this kind of aberration, and also that which arises from the spherical form of lenses, by an expedient of a very different nature, viz. increasing the number of eye-glasses.

88 Account of Mr Dollond's improvements.

If any person, says he, would have the visual angle of a telescope to contain 20 degrees, the extreme pencils of the field must be bent or refracted in an angle of 10 degrees; which, if it be performed by one eye-glass, will cause an aberration from the figure, in proportion to the cube of that angle; but if two glasses be so proportioned and situated, as that the refraction may be equally divided between them, they will each of them produce a refraction equal to half the required angle; and therefore, the aberration being proportional to the cube of half the angle taken twice over, will be but a fourth part of that which is in proportion to the cube of the whole angle; because twice the cube of one is but $\frac{1}{4}$ of the cube of 2; so the aberration from the figure, where two eye-glasses are rightly proportioned, is but a fourth of what it must unavoidably be, where the whole is performed by a single eye-glass. By the same way of reasoning, when the refraction is divided between three glasses, the aberration will be found to be but the ninth part of what would be produced from a single glass; because three times the cube of 1 is but one-ninth of the cube of 3. Whence it appears, that by increasing the number of eye-glasses, the indistinctness which is observed near the borders of the field of a telescope may be very much diminished.

The method of correcting the errors arising from the different refrangibility of light is of a different consideration from the former. For, whereas the errors from the figure can only be diminished in a certain proportion according to the number of glasses, in this they may be entirely corrected by the addition of only one glass. Also in the day-telescope, where no more than two eye-glasses are absolutely necessary for erecting the object, we find, that by the addition of a third, rightly situated, the colours, which would otherwise make the image confused, are entirely removed. This, however, is to be understood with some limitation: for though the different colours into which the extreme pencils must necessarily be divided by the edges of the eye-glasses, may in this manner be brought to the eye in a direction parallel to each other, so as to be made to converge to a point on the retina; yet, if the glasses exceed a certain length, the colours may be spread too wide to be capable of being admitted through the pupil or aperture of the eye; which is the reason, that in long telescopes, constructed in the common manner, with three eye-glasses, the field is always very much contracted.

These considerations first set Mr Dolload on contriving how to enlarge the field, by increasing the number of eye-glasses without affecting the distinctness or brightness of the image; and though others had been about the same work before, yet, observing that some five-glass telescopes which were then made would admit of farther improvement, he endeavoured to construct one with the same number of glasses in a better manner; which so far answered his expectations, as to be allowed by the best judges to be a considerable improvement on the former.

Encouraged by this success, he resolved to try if he could not make some farther enlargement of the field, by the addition of another glass, and by placing and proportioning the glasses in such a manner as to correct the aberrations as much as possible, without injuring the distinctness; and at last he obtained as large a field as is convenient or necessary, and that even in the longest telescopes that can be made.

These telescopes with six glasses having been well received, and some of them being carried into foreign countries, it seemed a proper time to the author to settle the date of his invention; on which account he drew up a letter, which he addressed to Mr Short, and which was read at the Royal Society, March 1. 1753.

Equatorial telescope, or portable observatory.

To Mr Short we are indebted for the excellent contrivance of an equatorial telescope, or, as he likewise called it, a *portable observatory*; for with it pretty accurate observations may be made with very little trouble, by those who have no building adapted to the purpose. The instrument consists of a piece of machinery, by which a telescope mounted upon it may be directed to any degree of right ascension or declination, so that the place of any of the heavenly bodies being known, they may be found without any trouble, even in the day-time. As it is made to turn parallel to the equator, any object is easily kept in view, or recovered, without moving the eye from its situation. By this instrument most of the stars of the first and second magnitude have been seen even at mid-day, when the sun was shining bright; as also

History. also Mercury, Venus, and Jupiter. Saturn and Mars are not so easy to be seen, on account of the faintness of their light, except when the sun is but a few hours above the horizon. This particular effect depends upon the telescope excluding almost all the light, except what comes from the object itself, and which might otherwise efface the impression made by its weaker light upon the eye. Any telescope of the same magnifying power would have the same effect, could we be sure of pointing it right. Mr Ramsden invented a *portable* or *equatorial telescope*, which may perhaps supersede the use of Mr Short's.

90 How to observe the stars in the day-time.

In order to see the fixed stars in the day-time, it is necessary to exclude the extraneous light as much as possible. For this reason the greater the magnifying power of any telescope is, the more easily a fixed star will be distinguished in the day-time; the light of the star remaining the same in all magnifying powers of the same telescope, but the ground upon which it is seen becoming darker by increasing the magnifying power; and the visibility of a star depends very much upon the difference between its own light and that of the ground upon which it is observed. A fixed star will be very nearly equally visible with telescopes of very different apertures, provided the magnifying power remains the same.

91 M. Epinus's proposal for bending the tubes of telescopes.

M. Æpinus proposes to bend the tubes of long telescopes at right angles, fixing a plane mirror in the angular point, in order to make them more commodious for viewing objects near the zenith; and he gives particular instructions how to make them in this form, especially when they are furnished with micrometers. We are also informed that a little plane speculum is sometimes placed betwixt the last eye-glass and the eye in the reflecting telescopes, at an angle of 45°, for the same purpose.

92 History of microscopes.

The invention of MICROSCOPES was not much later than that of telescopes; and, according to Borellus, we are indebted for them to the same author, at least to Zacharias Jansen, in conjunction with his son.

The Jansens, however, have not always enjoyed, undisturbed, that share of reputation to which they seem to be entitled, with respect either to the telescope or the microscope. The discovery of the latter, in particular, has generally been considered as more uncertain than that of the former. All that many writers say we can depend upon is, that microscopes were first used in Germany about the year 1621. Others say positively, that this instrument was the contrivance of Cornelius Drebell, a man of ingenuity, who also invented the thermometer.

According to Borellus, Zacharias Jansen and his son presented the first microscopes they had constructed to Prince Maurice, and Albert archduke of Austria. William Borell, who gives this account in a letter to his brother Peter, says, that when he was ambassador in England, in 1619, Cornelius Drebell, with whom he was intimately acquainted, showed him a microscope, which he said was the same that the archduke had given him, and had been made by Jansen himself. This instrument was not so short as they are generally made at present, but was six feet long, consisting of a tube of gilt copper, an inch in diameter, supported by three brass pillars in the shape of dolphins, on a base of ebony, on which the small objects were placed.

93 Microscope made by Jansen.

This microscope was evidently a compound one, or rather something betwixt a telescope and a microscope, so that it is possible that single microscopes might have been known, and in use, some time before: but perhaps nobody thought of giving that name to single lenses; though, from the first use of lenses, they could not but have been used for the purpose of magnifying small objects. In this sense we have seen, that even the ancients were in possession of microscopes; and it appears from Jamblicus and Plutarch, quoted by Dr Rogers, that they gave such instruments as they used for this purpose the name of *dioptra*. At what time lenses were made so small as we now generally use them for magnifying in single microscopes, we have not found. But as this must necessarily have been done gradually, the only proper object of inquiry is the invention of the double microscope; and this is clearly given, by the evidence of Borellus above mentioned, to Z. Jansen, or his son.

The invention of compound microscopes is claimed by the same Fontana who arrogated to himself the discovery of telescopes; and though he did not publish any account of this invention till the year 1646 (notwithstanding he pretended to have made the discovery in 1618), Montucla, from not attending perhaps to the testimony of Borellus, is willing to allow his claim, as he thought there was no other person who seemed to have any better title to it.

Eustachio Divini made microscopes with two common object-glasses, and two plano-convex eye-glasses joined together on their convex sides so as to meet in a point. The tube in which they were inclosed was very large, and the eye-glasses almost as broad as the palm of a man's hand. Mr Oldenburg, secretary to the Royal Society, received an account of this instrument from Rome, and read it at one of their meetings, August 6. 1668. 94 By Divini.

It was about this time that Hartsocker improved single microscopes, by using small globules of glass, made by melting them in the flame of a candle, instead of the lenses which had before been made use of for that purpose. By this means he first discovered the *animalcula in semine masculino*, which gave rise to a new system of generation. A microscope of this kind, consisting of a globule of $\frac{1}{10}$th of an inch in diameter, M. Huygens demonstrated to magnify 100 times; and since it is easy to make them of less than half a line in diameter, they may be made to magnify 300 times. 95 By Hartsocker.

But no man distinguished himself so much by microscopical discoveries as the famous M. Leeuwenhoek, though he used only single lenses with short foci, preferring distinctness of vision to a large magnifying power. 96 By Leeuwenhoek.

M. Leeuwenhoek's microscopes were all single ones, each of them consisting of a small double convex glass, set in a socket between two silver plates rivetted together, and pierced with a small hole; and the object was fixed on the point of a needle, which could be placed at any distance from the lens. If the objects were solid, he fastened them with glue; and if they were fluid, or required to be spread upon glass, he placed them on a small piece of Muscovy talc, or thin glass; which he afterwards glued to his needle. He had, however, a different apparatus for viewing the circulation of the blood, which he could attach to the same microscopes.

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M. Leeuwenhoek bequeathed the greatest part of his microscopes to the Royal Society. They were placed in a small Indian cabinet, in the drawers of which were 13 little boxes, each of which contained two microscopes, neatly fitted up in silver.

The glass of all these lenses is exceedingly clear, but none of them magnifies so much as those globules which are frequently used in other microscopes. Mr Folkes, who examined them, thought that they showed objects with much greater distinctness, a circumstance which M. Leeuwenhoek principally valued. His discoveries, however, are to be ascribed not so much to the goodness of his glasses, as to his great experience in using them.

Mr Baker, who also examined these microscopes, and reported concerning them to the Royal Society, found that the greatest magnifier enlarged the diameter of an object about 160 times, but that all the rest fell much short of that power. He therefore concluded that M. Leeuwenhoek must have had other microscopes of a much greater magnifying power for many of his discoveries.

It appears from M. Leeuwenhoek's writings, that he was not unacquainted with the method of viewing opaque objects by means of a small concave reflecting mirror, which was afterwards improved by M. Lieberkhun. For, after describing his apparatus for viewing eels in glass tubes, he adds, that he had an instrument to which he screwed a microscope set in brass, upon which microscope he fastened a little dish of brass, probably that his eye might be thereby assisted to see objects better; for he says he had filed the brass which was round his microscope as bright as he could, that the light, while he was viewing objects, might be reflected from it as much as possible. This microscope, with its dish, is constructed upon principles so similar to those which are the foundation of our single microscope by reflection (see MICROSCOPE,) that it may well be supposed to have given the hint to the ingenious inventor of it.

97 Wilson's microscope.

In 1702, Mr Wilson made several ingenious improvements in the method of using single magnifiers for the purpose of viewing transparent objects; and his microscope, which is also a necessary part of the solar microscope, is in very general use at this day. (See MICROSCOPE, sect. 1.)

98 Adams's method of making globules for large magnifiers.

In 1710, Mr Adams gave to the Royal Society the following account of his method of making small globules for large magnifiers. He took a piece of fine window-glass, and cut it with a diamond into several slips, not exceeding $\frac{1}{8}$ of an inch in breadth; then, holding one of them between the fore-finger and thumb of each hand over a very fine flame, till the glass began to soften, he drew it out till it was as fine as a hair, and broke; then putting each of the ends into the purest part of the flame, he had two globules, which he could increase or diminish at pleasure. If they were held a long time in the flame, they would have spots on them, so that he drew them out immediately after they became round. He broke off the stem as near to the globule as he could, and lodging the remainder between the plates, in which holes were drilled exactly round, the microscope, he says, performed to admiration. Through these magnifiers the same thread of very fine muslin appeared three or four times bigger than it did in the largest of Mr Wilson's magnifiers.

99 Temporary microscopes by Mr Grey.

The ingenious Mr Grey hit upon a very easy expedient to make very good temporary microscopes, at a very little expence. They consist of nothing but small drops of water taken up with the point of a pin, and put into a small hole made in a piece of metal. These globules of water do not, indeed, magnify so much as those which are made of glass of the same size, because the refractive power of water is not so great; but the same purpose will be answered nearly as well by making them somewhat smaller.

The same ingenious person, observing that small heterogeneous particles inclosed in the glass of which microscopes are made, were much magnified when those glasses were looked through, thought of making his microscopes of water that contained living animalcula, to see how they would look in this new situation; and he found his scheme to answer beyond his expectation, so that he could not even account for their being magnified so much as they were: for it was much more than they would have been magnified if they had been placed beyond the globule, in the proper place for viewing objects. But Montucla observes, that, when any object is inclosed within this small transparent globule, the hinder part of it acts like a concave mirror, provided they be situated between that surface and the focus; and that, by this means, they are magnified above $3\frac{1}{3}$ times more than they would have been in the usual way.

100 Microscopes of turpentine varnish by Dr Brewster.

Temporary microscopes of a different kind have been constructed by Dr Brewster. They were composed of turpentine varnish, which was formed into a plano-convex lens, by laying a drop of it upon a piece of plain glass: the under surface of the glass was then smoked, and the black pigment removed immediately below the fluid lens. These lens lasted for a long time, and shewed objects distinctly, even when combined into a compound microscope. See *Appendix to Ferguson's Lectures*, vol. ii. and MICROSCOPE, p. 19.

101 Reflecting microscope, by Dr Barker.

After the successful construction of the reflecting telescope, it was natural to expect that attempts would also be made to render a similar service to microscopes. Accordingly we find two plans of this kind. The first was that of Dr Robert Barker. His instrument differs in nothing from the reflecting telescope, excepting the distance of the two speculums, in order to adapt it to those pencils of rays which enter the microscope diverging; whereas they come to the telescope from very distant objects nearly parallel to each other.

This microscope is not so easy to manage as those of the common kind. For vision by reflection, as it is much more perfect, so it is far more difficult than that by refraction. Nor is this microscope so useful for any but very small or transparent objects. For the object, being between the speculum and image, would, if it were large and opaque, prevent a due reflection.

102 Dr Smith's reflecting microscope superior to all others.

Dr Smith invented a double reflecting microscope, of which a theoretical and practical account is given in his remarks at the end of the second volume of his System of Optics. As it is constructed on principles different from all others, and in the opinion of some, superior to them all, the reader will not be displeased with the following practical description.

Plate CCCLXXVII. fig. 2.

A section of this microscope is shewn in fig. 2. where ABC and *a b c* are two specula, the former concave, and the latter convex, inclosed within the tube DEFG. The speculum ABC is perforated, and the object to be viewed

History. viewed is so placed between the centre and principal focus of that speculum, that the rays flowing from it to ABC are reflected towards an image *p q*. But before that image is formed, they are intercepted by the convex speculum *a b c*, and thence reflected through the hole BC in the vertex of the concave to a second image *π x*, to be viewed through an eye-glass *l*. The object may either be situated between the two specula, or, which is perhaps better, between the principal focus and vertex *c* of the convex speculum *a b c*, a small hole being made in its vertex for the transmission of the incident rays. When the microscope is used, let the object be included between two little round plates of Muscovy-glass, fixed in a hole of an oblong brass plate *u m*, intended to slide close to the back side of the convex speculum: which must therefore be ground flat on that side, and so thin that the object may come precisely to its computed distance from the vertex of the speculum. The slider must be kept tight to the back of the metal by a gentle spring. The distance of the object being thus determined, distinct vision to different eyes, and through different eye-glasses, must be procured by a gentle motion of the little tubes that contain these glasses. These tubes must be made in the usual form of those that belong to Sir Isaac Newton's reflecting telescope, having a small hole in the middle of each plate, at the ends of the tube, situated exactly in each focus of the glass: The use of these holes and plates is to limit the visible area, and prevent any straggling rays from entering the eye. To the tube of the eye-glass is fastened the arm *g*, on which the adjusting screw turns. A similar arm *u* is attached to the fixed tube X, in which the neck of the screw turns; and by turning the button *y*, the eye-tube is moved farther from or nearer to the object, by which means different sorts of eyes obtain distinct vision.

The rays which flow from the object directly through the hole in the concave speculum and through the eye-glass, by mixing with the reflected rays, would dilute the image on the retina, and therefore must be intercepted. This is done by a very simple contrivance. The little hole in the convex speculum is ground conical as in the figure; and a conical solid P, of which the base is larger than the orifice in the back of the convex speculum, supported on the slender pillar PQ, is so placed as to intercept all the *direct* rays from the eye-glass. The tubes are strongly blacked on their insides, and likewise the conical solid, to hinder all reflection of rays upon the convex speculum. The little base, too, of the solid should be made concave, that whatever light it may still reflect, may be thrown back upon the object; and its back-side being conical and blacked all over, will either absorb or laterally disperse any straggling rays which the concave speculum may scatter upon it, and so prevent their coming to the eye-glass.

Notwithstanding the interposition of this conical solid, yet when the eye-glass is taken out, distant objects may be distinctly seen through the microscope, by rays reflected from the metals, and diverging upon the eye from an image behind the convex speculum. But this mixture of foreign rays with those of the object, which is common to all kinds of microscopes in viewing transparent objects, is usually prevented by placing before the object a thick double convex lens *l*, to collect the sky light exactly upon the object. This lens should be just so broad as to subtend the opposite angle to that which the concave speculum subtends at the object. The annular frame of the lens must be very narrow, and connected with the microscope by two or three slender wires or blades, whose planes produced may pass through the object, and intercept from it as little sky light as possible. History.

This is not the place for explaining the principles of this microscope, or demonstrating its superiority over most others; nor are such explanation and demonstration necessary. Its excellence, as well as the principles upon which it is constructed, will be perceived by the reader, when he has made himself master of the laws of refraction and reflection as laid down in the sequel of this article. 103

Solar microscope, and that for opaque objects.

M. Lieberkuhn, in 1738 or 1739, made two capital improvements in microscopes, by the invention of the *solar microscope*, and the *microscope for opaque objects*. When he was in England in the winter of 1739, he showed an apparatus for each of these purposes, made by himself, to several gentlemen of the Royal Society, as well as to some opticians.

The microscope for opaque objects remedies the inconvenience of having the dark side of an object next the eye. For by means of a concave speculum of silver, highly polished, in the centre of which a magnifying lens is placed, the object is so strongly illuminated that it may be examined with all imaginable ease and pleasure. A convenient apparatus of this kind, with four different specula and magnifiers of different powers, was brought to perfection by Mr Cuff in Fleet-street. M. Lieberkuhn made considerable improvements in his solar microscope, particularly in adapting it to the view of opaque objects; but in what manner this was effected, M. Æpinus, who was highly entertained with the performance, and who mentions the fact, was not able to recollect; and the death of the ingenious inventor prevented his publishing any account of it himself. M. Æpinus invites those who came into the possession of M. Lieberkuhn's apparatus to publish an account of this instrument; but it does not appear that his method was ever published.

This improvement of M. Lieberkuhn's induced M. Æpinus himself to attend to the subject; and he thus produced a very valuable improvement in this instrument. For by throwing the light upon the foreside of any object by means of a mirror, before it is transmitted through the object lens, all kinds of objects are equally well represented by it. 104

Reflected light introduced into the microscope and magic lantern.

M. Euler proposed to introduce vision by reflected light into the magic lantern and solar microscope, by which many inconveniences to which those instruments are subject might be avoided. For this purpose, he says, that nothing is necessary but a large concave mirror, perforated as for a telescope; and the light should be so situated, that none of it may pass directly through the perforation, so as to fall on the images of the objects upon the screen. He proposes to have four different machines, for objects of different sizes; the first for those of six feet long, the second for those of one foot, the third for those of two inches, and the fourth for those of two lines; but it is needless to be particular in the description

History. scription of these, as more perfect instruments are described under the article MICROSCOPE.

Several improvements were made in the apparatus to the solar microscope, as adapted to view opaque objects, by M. Zeiher, who made one construction for the larger kind of objects, and another for the small ones.

105 Mr Martin's improvement in the solar microscope.

Mr Martin having constructed a solar microscope of a larger size than common, for his own use, the illuminating lens being $4\frac{1}{2}$ inches in diameter, and all the other parts of the instrument in proportion, found, that by the help of an additional part, which he does not describe, he could see even opaque objects very well. If he had made the lens any larger, he was aware that the heat produced at the focus would have been too great for most objects to bear. The expence of this instrument, he says, does not much exceed the price of the common solar microscope.

106 Di Torre's extraordinary magnifying microscope.

The smallest globules, and consequently the greatest magnifiers, for microscopes, that have yet been executed, were made by T. Di Torre of Naples, who, in 1765, sent four of them to the Royal Society. The largest of them was only two Paris points in diameter, and it was said to magnify the diameter of an object 640 times. The second was the size of one Paris point, and the third was no more than half of a Paris point, or the 144th part of an inch in diameter, and was said to magnify the diameter of an object 2560 times. One

107 Could not be used by Mr Baker.

of these globules was wanting when they came into the hands of Mr Baker, to whose examination they were submitted by the Royal Society. This gentleman, however, was not able to make any use of these. With that which magnifies the least, he was not able to see any object with satisfaction; and he concludes his account with expressing his hopes only, that, as his eyes had been much used to microscopes, they were not injured by the attention he had given to them, though he believed there were few persons who would not have been blinded by it.

The construction of a telescope with six eye-glasses led M. Euler to a similar construction of microscopes, by introducing into them six lenses, one of which admits of so small an aperture, as to serve, instead of a diaphragm, to exclude all foreign light, though, as he says, it neither lessens the field of view, nor the brightness of objects.

108 Difficulties attending the construction of dioptric instruments.

The improvement of all dioptric instruments is greatly impeded by inequalities in the substance of the glass of which they are formed; but though many attempts have been made to make glass without that imperfection, none of them have been hitherto quite effectual. M. A. D. Merklein, having found some glass which had been melted when a building was on fire, and which proved to make excellent object-glasses for telescopes, concluded that its peculiar goodness arose from its not having been disturbed when it was in a fluid state; and therefore he proposed to take the metal out of the furnace in iron vessels, of the same form that was wanted for the glass; and after it had been perfectly fluid in those vessels, to let it stand to cool, without any disturbance. This, however, is not always found to answer.

PART I. THEORY OF OPTICS.

THE science of optics is commonly divided into three parts, *Dioptrics*, which treats of the laws of refraction, and the phenomena depending upon them; *Catoptrics*, which treats of the laws of reflection, and the phenomena connected with them; and, lastly, *Chromatics*, which treats of the phenomena of colour. But this division is of no use in a treatise of Optics, as most of the phenomena depend both on refraction and reflection, colour itself not excepted. For this reason, though we have given detached articles under the words DIOPTRICS, CATOPTRICS, and CHROMATICS; we have reserved for this place the explanation of the laws of reflection and refraction, by which all optical phenomena may be explained.

CHAP. I. *On Light.*

UNDER the article LIGHT we have given some account of the controversies concerning its nature. The opinions of philosophers may, in general, be arranged under these two: 1. That light is produced by the undulations of an elastic fluid, nearly in the same manner as sound is produced by the undulations of the air.

109 Different opinions concerning the nature of light.

This opinion was first offered to the public by Des Cartes, and afterwards by Mr Huygens. It was revived by Euler, and has lately found an able and ingenious defender in Dr Thomas Young.—2d, That the phenomena of vision are produced by the motion and action of matter emitted from the shining body with immense velocity, moving uniformly in straight lines, and acted on by other bodies; so as to be reflected, refracted, or inflected, in various ways, by means of forces which act on it in the same manner as on other inert matter. Sir Isaac Newton has ably shown the dissimilarity between the phenomena of vision and the legitimate consequences of the undulations of an elastic fluid. All M. Euler's ingenious and laborious discussions have not removed Newton's objections in the smallest degree. Sir Isaac adopts the vulgar opinion, therefore, because the difficulties attending this opinion are not inconsistent with the established principles of mechanics, and are merely difficulties of conception to limited faculties like ours. We need not despair of being able to decide, by experiment, which of these opinions is nearest to the truth; because there are phenomena where the result should be sensibly different in the two hypotheses. At present, we shall content ourselves with giving some account of the legitimate consequences of the vulgar opinion, as modified by Sir Isaac Newton, viz. that light consists of small particles emitted with very great velocity, and attracted or repelled by other bodies at very small distances.

110 Light is emitted in straight lines from each point of a surface.

Every visible body emits or reflects inconceivably small particles of matter from each point of its surface, which issue from it continually, not unlike sparks from a coal, in straight lines and in all directions. These particles

Refraction. particles entering the eye, and striking upon the retina (an expansion of the optic nerve over the back part of the eye to receive their impulses), excite in our minds the idea of light. And according as they differ in substance, density, velocity, or magnitude, they produce in us the ideas of different colours; as will be explained in its proper place.

That the particles which constitute light are exceedingly small, appears from this, that if a hole be made through a piece of paper with a needle, rays of light from every object on the farther side of it are capable of being transmitted through it at once without the least confusion; for any one of those objects may as clearly be seen through it, as if no rays passed through it from any of the rest. Besides, if a candle is lighted, and there be no obstacle in the way to obstruct the progress of its rays, it will fill all the space within some miles of it every way with luminous particles, before it has lost the least sensible part of its substance in consequence of this copious emission.

It is evident that these particles proceed from every point of the surface of a visible body, and in all directions, because wherever a spectator is placed with regard to the body, every point of that part of the surface which is turned towards him is visible. That they proceed from the body in right lines, we are assured, because just so many and no more will be intercepted in their passage to any place by an interposed object, as that object ought to intercept, supposing them to come in such lines.

The velocity with which they proceed from the surface of the visible body is no less surprising than their minuteness: the method by which philosophers estimate their velocity, is by observations made on the eclipses of Jupiter's satellites; which eclipses appear to us about seven minutes sooner than they ought to do by calculation, when the earth is placed between the sun and him, that is, when we are nearest to him; and as much later, when the sun is between him and us, at which time we are farthest from him. Hence it is concluded, that they require about seven minutes to pass over a space equal to the distance of the earth from the sun.

A stream of these particles issuing from the surface of a visible body in one and the same direction, is called a *ray of light*.

As rays proceed from a visible body in all directions, they necessarily become thinner and thinner, continually spreading themselves as they pass along into a larger space, and that in proportion to the squares of their distances from the body; that is, at the distance of two spaces, they are four times thinner than they are at one; at the distance of three spaces, nine times thinner, and so on.

Chap. II. *On Refraction.*

111 Refraction defined.

Light, when proceeding from a luminous body, is invariably found to proceed in straight lines, without the least deviation. But, if it happens to pass obliquely from one medium to another, it always leaves the direction it had before, and assumes a new one; and this change of course is called its *refraction*. After having taken this new direction, it then proceeds invariably in a straight line till it meets with a different medium, when it is again turned out of its course. It must be observed, however, that though by this means we may cause the rays of light to make any number of angles in their course, it is impossible to make them describe a curve, except in one single case, namely, where they pass through a medium, the density of which uniformly either increases or decreases. This is the case with the light of the celestial bodies, which passes downwards through our atmosphere, and likewise with that which is reflected upwards through it by terrestrial objects. In both these cases, it describes a curve of the hyperbolic kind; but at all other times it proceeds in straight lines, or in what may be taken for straight lines, without any sensible error.

Cause of Refraction.

Sect. I. *On the cause of Refraction, and the Law by which it is performed.*

112 Phenomena of refraction solved by an attractive power in the medium.

The phenomena of refraction are explained by an attractive power in the medium through which light passes, in the following manner. All bodies being endowed with an attractive force, which is extended to some distance beyond their surfaces; when a ray of light passes out of a rarer into a denser medium (if this latter has a greater attractive force than the former, as is commonly the case), the ray, just before its entrance, will begin to be attracted towards the denser medium; and this attraction will continue to act upon it, till some time after it has entered the medium; and therefore, if a ray approaches a denser medium in a direction perpendicular to its surface, its velocity will be continually accelerated during its passage through the space in which that attraction exerts itself; and therefore, after it has passed that space, it will move on, till it arrive at the opposite side of the medium, with a greater degree of velocity than it had before it entered. So that in this case its velocity only will be altered. Whereas, if a ray enters a denser medium obliquely, it will not only have its velocity augmented thereby, but its direction will become less oblique to the surface. Just as when a stone is thrown downwards obliquely from a precipice, it falls to the surface of the ground in a direction nearer to a perpendicular one, than that with which it was thrown from the hand. Hence we see a ray of light, in passing out of a rarer into a denser medium, is refracted towards the perpendicular; that is, supposing a line drawn perpendicularly to the surface of the medium, through the point where the ray enters, and extended both ways, the ray in passing through the surface is refracted or bent towards the perpendicular line; or, which is the same thing, the line which it describes by its motion after it has passed through the surface, makes a less angle with the perpendicular, than the line which is described before. These positions may be illustrated in the following manner.

Plate CCCLXXVII Fig. 3.

Let us suppose first, that the ray passes out of a vacuum into the denser medium ABCD (fig. 3.), and that the attractive force of each particle in the medium is extended from its respective centre to a distance equal to that which is between the lines AB and EF, or AB and GH; and let KL be the path described by a ray of light in its progress towards the denser medium. This ray, when it arrives at L, will enter the sphere of attraction of those particles which lie in AB the surface of the denser medium, and will therefore cease to proceed any longer in the right line KLM, but will be diverted from its course by being attracted towards

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wards the line AB, and will begin to describe the curve LN, passing through the surface AB in some new direction, as OQ; making a less angle with a line PR, drawn perpendicularly through the point N, than it would have done had it proceeded in its first direction KLM.

As we have supposed the attractive force of each particle to be extended through a space equal to the distance between AB and EF, it is evident that the ray, after it has entered the surface, will still be attracted downwards, till it has arrived at the line EF; for, till then, there will not be so many particles above it which will attract it upwards, as below, that will attract it downwards. So that after it has entered the surface at N, in the direction OQ, it will not proceed in that direction, but will continue to describe a curve, as NS; after which it will proceed straight on towards the opposite side of the medium, being attracted equally every way; and therefore will at last proceed in the direction XST, still nearer the perpendicular PR than before.

If we suppose ABZY not to be a vacuum, but a rarer medium than the other, the case will still be the same; but the ray will not be so much refracted from its rectilineal course, because the attraction of the particles of the upper medium being in a contrary direction to that of the attraction of those in the lower one, the attraction of the denser medium will in some measure be destroyed by that of the rarer.

When a ray, on the contrary, passes out of a denser into a rarer medium, if its direction be perpendicular to the surface of the medium, it will only lose somewhat of its velocity, in passing through the spaces of attraction of that medium (that is, the space wherein it is attracted more one way than it is another). If its direction be oblique, it will continually recede from the perpendicular during its passage, and by that means, have its obliquity increased, just as a stone thrown up obliquely from the surface of the earth increases its obliquity all the time it rises. Thus, supposing the ray TS passing out of the denser medium ABCD into the rarer ABZY, when it arrives at S it will begin to be attracted downwards, and so will describe the curve SNL, and then proceed in the right line LK; making a larger angle with the perpendicular PR, than the line TSX in which it proceeded during its passage through the other medium.

We may here make a general observation on the forces which produce this deviation of the rays of light from their original path. They arise from the joint action of all the particles of the body which are sufficiently near the particle of light; that is, whose distance from it is not greater than the line AE or GA; and therefore the whole force which acts on a particle in its different situations between the planes GH and EF, follows a very different law from the force exerted by one particle of the medium.

The space through which the attraction of cohesion of the particles of matter is extended is so very small, that in considering the progress of a ray of light out of one medium into another, the curvature it describes in passing through the space of attraction is generally neglected; and its path is supposed to be bent or refracted, only in the point where it enters the denser medium.

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Now the line which a ray describes before it enters a denser or a rarer medium, is called the *incident ray*; and that which it describes after it has entered, is the *refracted ray*.

The angle comprehended between the incident ray and the perpendicular, is the *angle of incidence*; and that between the refracted ray and the perpendicular, is the *angle of refraction*.

There is a certain and immutable law, by which refraction is always performed; which is this: Whatever inclination a ray of light has to the surface of any medium before it enters it, the degree of refraction will always be such, that the sine of the angle of incidence and that of the angle of refraction, will always have a constant ratio to one another in that medium.

Plate CCCLXXVII fig. 4.

To illustrate this: Let us suppose ABCD (fig. 4.) to represent a rarer, and ABEF a denser medium: let GH be a ray of light passing through the first and entering the second at H, and let HI be the refracted ray: then supposing the perpendicular PR drawn through the point H, on the centre H, and with any radius, describe the circle ABPR; and from G and I, where the incident and refracted rays cut the circle, let fall the lines GK and IL perpendicularly upon the line PR; the former of these will be the sine of the angle of incidence, the latter of refraction. Now if in this case the ray GH is so refracted at H, that GK is double or triple, &c. of IL, then, whatever other inclination the ray GH might have had, the sine of its angle of incidence would have been double or triple, &c. to that of its angle of refraction. For instance, had the ray passed in the line MH before refraction, it would have passed in some line as HN afterwards, so situated that MO should have been double or triple, &c. of NQ.

The following table contains the refractive densities of several bodies.

Diamond, -	2.500
Flint glass, -	1.585
Plate glass, -	1.502
Crown glass, -	1.525
Sulphuric acid, -	1.435
Solution of potash,	1.390
Olive oil, -	1.469
Alcohol, -	1.370
Atmospheric air,	1.000276
Ice, - -	1.31
Water, - -	1.336

This relation of the sine of the angle of incidence to that of refraction, which is a proposition of the most extensive use in explaining the optical phenomena on physical or mechanical principles, may be demonstrated in the following easy and familiar manner.

Lemma I.

The augmentations or diminutions of the squares of the velocities produced by the uniform action of accelerating or retarding forces, are proportional to the forces, and to the spaces along which they act, jointly; or are proportional to the products of the forces multiplied by the spaces.

Let two bodies be uniformly accelerated from a state of rest in the points A a, along the spaces AB, ab, fig. 5. by Fig. 5.

Law of Refraction.

by the accelerating forces F f, and let AC, $a\,c$, be spaces described in equal times; it is evident, from what has been said under the articles GRAVITY and ACCELERATION, that because these spaces are described with motions uniformly accelerated, AC and $a\,c$ are respectively the halves of the spaces which would be uniformly described during the same time with the velocities acquired at C and c, and are therefore measures of these velocities. And as these velocities are uniformly acquired in equal times, they are measures of the accelerating forces. Therefore, AC : ac=F : f. Also, from the nature of uniformly accelerated motion, the spaces are proportional to the squares of the acquired velocities. Therefore, (using the symbols $\surd^2$C, $\surd^2 c$, &c. to express the squares of the velocities at C c, &c.) we have

Fig. 5.

$$\surd^2 B : \surd^2 C = AB : AC$$
$$\surd^2 C : \surd^2 c = AC^2 : a\,c^2$$
$$\surd^2 c : \surd^2 b = a\,c : a\,b$$

Therefore, by equality of compound ratios

$\surd^2 B : \surd^2 b = AB \times AC : ab \times ac, = AB \times F : ab \times f$.
And in like manner $\surd^2 D : \surd^2 d \surd AD \times F : ad \times f$;
and $\surd^2 B - \surd^2 D : \surd^2 b - \surd^2 d = BD \times F : bd \times f$.
Q. E. D.

COROLLARY. If the forces are as the spaces inversely, the augmentations or diminutions of the squares of the velocities are equal.

Remark. If D B, $d\,b$, be taken extremely small, the products BD $\times$ F and $b\,d \times f$ may be called the momentary actions of the forces, or the momentary increments of the squares of the velocities. It is usually expressed, by the writers on the higher mechanics, by the symbol $f\dot{s}$, or $f\,d\,s$, where f means the accelerating force, and $\dot{s}$ or $d\,s$ means the indefinitely small space along which it is uniformly exerted. And the proposition is expressed by the fluxionary equation $f\dot{s} = v\dot{v}$ because $v\dot{v}$ is half the increment of v^2, as is well known.

LEMMA II.

Plate CCCLXXVII. fig. 6.

If a particle of matter, moving with any velocity along the line AC, be impelled by an accelerating or retarding force, acting in the same or in the opposite direction, and if the intensity of the force in the different points B, F, H, C, &c. be as the ordinates BD, FG, &c. to the line DGE, the areas BFGD, BHKD, &c. will be as the changes made on the square of the velocity, at B, when the particle arrives at the points F, H, &c.

For let BC be divided into innumerable small portions, of which let FH be one, and let the force be supposed to act uniformly, or to be of invariable intensity during the motion along FH; draw GI perpendicular to HK: It is evident that the rectangle FHIG will be as the product of the accelerating force by the space along which it acts, and will therefore express the momentary increment of the square of the velocity. (Lemma I.). The same may be said of every such rectangle. And if the number of the portions, such as FH, be increased, and their magnitude diminished without end, the rectangles will ultimately occupy the whole curvilineal area, and the force will therefore be as the finite changes made on the square of the velocity, and the proposition is demonstrated.

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COROLLARY. The whole change made on the square of the velocity, is equal to the square of that velocity which the accelerating force would communicate to the particle by impelling it along BC from a state of rest in B. For the area BCED will still express the square of this velocity, and it equally expresses the change made on the square of *any* velocity wherewith the particle may pass through the point B, and is independent on the magnitude of that velocity.

Remark. The figure is adapted to the case where the forces all conspire with the initial motion of the particle, or all oppose it, and the area expresses an augmentation or a diminution of the square of the initial velocity. But the reasoning would have been the same, although, in some parts of the line B C, the forces had conspired with the initial motion, and in other parts had opposed it. In such a case, the ordinates which express the intensity of the forces must lie on different sides of the abscissa BC, and that part of the area which lies on one side must be considered as negative with respect to the other, and be subtracted from it. Thus, if the forces be represented by the ordinates of the dotted curve line DH e, which crosses the abscissa in H, the figure will correspond to the motion of a particle, which, after moving uniformly along AB, is subjected to the action of a variable accelerating force during its motion along BH, and the square of its initial velocity is increased by the quantity BHD; after which it is retarded during its motion along HC, and the square of its velocity in H is diminished by a quantity HC e. Therefore the square of the initial velocity is changed by a quantity BHB—HC e, or HC e—BHD.

This proposition, which is the 39th of the 1st book of the Principia, is perhaps the most important in the whole science of mechanics, being the foundation of every application of mechanical theory to the explanation of natural phenomena. No traces of it are to be found in the writings of philosophers before the publication of Newton's Principia, though it is assumed by John Bernoulli and other foreign mathematicians, as an elementary truth, without any acknowledgment of their obligations to its author. It is usually expressed by the equation $f\dot{s} = v\dot{v}$ and $\int f\dot{s} = v^2$, i. e. *the sum of the momentary actions is equal to the whole or finite increment of the square of the velocity.*

PROPOSITION.

When light passes obliquely into or out of a transparent substance, it is refracted so that the sine of the angle of incidence is to the sine of the angle of refraction in the constant ratio of the velocity of the refracted light to that of the incident light.

113 The ratio of the sine of incidence to the sine of refraction.

Plate CCCLXXVII. fig. 7.

LET ST, KR, represent two planes (parallel to, and equidistant from, the refracting surface XY) which bound the space in which the light, during its passage, is acted on by the refracting forces.

The intensity of the refracting forces being supposed equal at equal distances from the bounding planes, though anyhow different at different distances from them, may be represented by the ordinates T a, $n\,q$, $p\,r$, c R, &c. of the curve $a\,b\,n\,p\,c$, of which the form must be

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be determined from observation, and may remain for ever unknown. The phenomena of inflected light show us that it is attracted by the refracting substance at some distances, and repelled at others.

Let the light, moving uniformly in the direction AB, enter the refracting stratum at B. It will not proceed in that direction, but its path will be incurvated upwards, while acted on by a repulsive force, and downwards, while impelled by an attractive force. It will describe some curvilineal path B d o CDE, which AB touches in B, and will finally emerge from the refracting stratum at E, and move uniformly in a straight line EF, which touches the curve in E. If, through b, the intersection of the curve of forces with its abscissa, we draw b o, cutting the path of the light in o, it is evident that this path will be concave upwards between B and o, and concave downwards between o and E. Also, if the initial velocity of the light has been sufficiently small, its path may be so much bent upwards, that in some point d its direction may be parallel to the bounding planes. In this case it is evident, that being under the influence of a repulsive force, it will be more bent upwards, and it will describe d f, equal and similar to d B, and emerge in an angle g f s, equal to ABG. In this case it is reflected, making the angle of reflection equal to that of incidence. By which it appears how reflection, refraction, and inflection, are produced by the same forces and performed by the same laws.

But let the velocity be supposed sufficiently great to enable the light to penetrate through the refracting stratum, and emerge from it in the direction EF; let AB and EF be supposed to be described in equal times: They will be proportional to the initial and final velocities of the light. Now, because the refracting forces *must* act in a direction perpendicular to the refracting surface (since they arise from the joint action of all the particles of a homogeneous substance which are within the sphere of mutual action), they cannot affect the motion of the light estimated in the direction of the refracting surface. If, therefore, AG be drawn perpendicular to ST, and FK to KR, the lines GB, EK, must be equal, because they are the motions AB, EF, estimated in the direction of the planes. Draw now EL parallel to AB. It is also equal to it. Therefore, EL, EF, are as the initial and final velocities of the light. But EF is to EL as the sine of the angle ELK to the sine of the angle EFK; that is, as the sine of the angle ABH to the sine of the angle FEI; that is, as the sine of the angle of incidence to the sine of the angle of refraction.

By the same reasoning it will appear that light, moving in the direction and with the velocity FE, will describe the path EDB, and will emerge in the direction and with the velocity BA.

Let another ray enter the refracting stratum perpendicularly at B, and emerge at Q. Take two points N, P, in the line BQ, extremely near to each other, so that the refracting forces may be supposed to act uniformly along the space NP: draw NC, PD, parallel to ST, CM perpendicular to DP, and MO perpendicular to CD, which may be taken for a straight line. Then, because the forces at C and N are equal, by supposition they may be represented by the equal lines CM and NP. The force NP is wholly employed in accelerating the light along NP; but the force CM being transverse to the motion BD, is but partly so employed, and may be conceived as arising from the joint action of the forces CO, OM, of which CO only is employed in accelerating the motion of the light, while OM is employed in incurvating its path. Now it is evident, from the similarity of the triangles DCM, MCO, that DC : CM = CM : CO, and that $DC \times CO = CM \times CM = NP \times NP$. But $DC \times CO$ and $NP \times NP$ are as the products of the spaces by the accelerating forces, and express the momentary increments of the squares of the velocities at C and N. (Lemma 1.). These increments, therefore, are equal. And as this must be said of every portion of the paths BCE and BNQ, it follows that the whole increment of the square of the initial velocity produced in the motion along BCE, is equal to the increment produced in the motion along BNQ. And, because the initial velocities were equal in both paths, their squares were equal. Therefore the squares of the final velocities are also equal in both paths, and the final velocities themselves are equal. The initial and final velocities are therefore in a constant ratio, whatever are the directions; and the ratio of the sines of the angles of incidence and refraction being the ratio of the velocities of the refracted and incident light, by the former case of Prop. 1. is also constant.

Remark. The augmentation of the square of the initial velocity is equal to the square of the velocity which a particle of light would have acquired, if impelled from a state of rest at B along the line BQ. (Corol. of the Lemma 2.), and is therefore independent on the initial velocity. As this augmentation is expressed by the curvilineal area a T b n p c R, it depends both on the intensity of the refracting forces, expressed by the ordinates, and on the space through which they act, viz. TR. These circumstances arise from the nature of the transparent substance, and are characteristic of that substance. Therefore, to abbreviate language, we shall call this the *specific velocity.*

This specific velocity is easily determined for any substance in which the refraction is observed, by drawing L i perpendicular to EL, meeting in i the circle described with the radius EF. For E i being equal to EF, will represent the velocity of the refracted light, and EL represent the velocity of the incident light, and $\mathrm{E}i^2 = \mathrm{EL}^2 + \mathrm{L}i^2$, and therefore $\mathrm{L}i^2$ is the augmentation of the square of the initial velocity, and L i is the specific velocity.

It will now be proper to deduce some corollaries from these propositions, tending to explain the chief phenomena of refraction.

11[illegible] The [illegible] of light [illegible] known or [illegible] by refraction.

Cor. 1. When light is refracted towards the perpendicular to the refracting surface it is accelerated; and it is retarded when it is refracted from the perpendicular. In the first case, therefore, it must be considered as having been acted on by forces conspiring (in part at least) with its motion, and *vice versa.* Therefore, because we see that it is always refracted towards the perpendicular, when passing from a void into any transparent substance, we must conclude that it is, on the whole, attracted by that substance. We must draw the same conclusion from observing, that it is refracted from the perpendicular in its passage out of any transparent substance whatever into a void. It has been attracted backwards by that substance.

This

Law of Refraction.

This acceleration of light in refraction is contrary to the opinion of those philosophers who maintain that illumination is produced by the undulation of an elastic medium. Euler attempts to prove, by mechanical laws, that the velocities of the incident and refracted light, are proportional to the sines of incidence and refraction, while our principles make them in this ratio inversely. Boscovich proposed a fine experiment for deciding this question. The aberration of the fixed stars arises from the combination of the motion of light with the motion of the telescope by which it is observed. Therefore this aberration should be greater or less when observed by means of a telescope filled with water, according as light moves slower or swifter through water than through air. He was mistaken in the manner in which the conclusion should be drawn from the observation made in the form prescribed by him: and the experiment has not yet been made in a convincing manner; because no fluid has been found of sufficient transparency to admit of the necessary magnifying power. It is an experiment of the greatest importance to optical science.

Plate CCCXXVII. fig. 8.

Cor. 2. If the light be moving within the transparent substance, and if its velocity (estimated in a direction perpendicular to the surface) do not exceed the specific velocity of that substance, it will not emerge from it, but will be reflected backwards in an angle equal to that of its incidence. For it must be observed, that in the figure of last proposition, the excess of the square of EF above the square of EL, is the same with the excess of the square of KF above the square of KL. Therefore the square of the specific velocity is equal to the augmentation or diminution of the square of the perpendicular velocity. If therefore the initial perpendicular velocity FK be precisely equal to the specific velocity, the light will just reach the farther side of the attracting stratum, as at B, where its perpendicular velocity will be completely extinguished, and its motion will be in the direction BT. But it is here under the influence of forces tending towards the plane KR, and its motion will therefore be still incurvated towards it; and it will describe a curve BD equal and similar to EB, and finally emerge back from the refracting stratum into the transparent substance in an angle RDA equal to KEF.

If the direction of the light be still more oblique, so that its perpendicular velocity is less than the specific velocity, it will not reach the plane ST, but be reflected as soon as it has penetrated so far that the specific velocity of the part penetrated (estimated by the compounding part of the area of forces) is equal to its perpendicular velocity. Thus the ray f E will describe the path E d D a penetrating to b d, so that the corresponding area of forces $a\ b\ c\ e$ is equal to the square of $f\,k$, its perpendicular velocity.

The extreme brilliancy of dew drops and of jewels had often excited the attention of philosophers, and it always appeared a difficulty how light was reflected at all from the posterior surface of transparent bodies. It afforded Sir Isaac Newton his strongest argument against the usual theory of reflection, viz. that it was produced by impact on solid elastic matter. He was the first who took notice of the total reflection in great obliquities; and very properly asked how it can be said that there is any impact in this case, or that the reflecting impact should cease at a particular obliquity?

115 Rays at a certain obliquity are wholly reflected by transparent substances.

It must be acknowledged that it is a very curious circumstance, that a body which is perfectly transparent should cease to be so at a certain obliquity; that a great obliquity should not hinder light from passing from a void into a piece of glass; but that the same obliquity should prevent it from passing from the glass into a void. The finest experiment for illustrating the fact is, to take two pieces of mirror-glass, not silvered, and put them together with a piece of paper between them, forming a narrow margin all round to keep them apart. Plunge this apparatus into water. When it is held nearly parallel to the surface of the water, every thing at the bottom of the vessel will be seen clearly through the glasses; but when they are turned so as to be inclined about 50 degrees, they will intercept the light as much as if they were plates of iron. It will be proper to soak the paper in varnish, to prevent water from getting between the glasses.

116 The brilliant cut in diamonds produces total reflection.

What is called the brilliant cut in diamonds, is such a disposition of the posterior facets of the diamond, that the light is made to fall upon them so obliquely that none of it can go through, but all is reflected. To produce this effect in the greatest possible degree is a matter of calculation, and merits the attention of the lapidary. When diamonds are too thin to admit of this form, they are cut in what is called the rose fashion. This has a plain back, and the facets are all on the front, and so disposed as to refract the rays into sufficient obliquities, to be strongly reflected from the posterior plane. Doublets are made by cutting one thin diamond rose fashion, and another similar one is put behind it, with their plane surfaces joined. Or, more frequently, the outside diamond has the anterior facets of the brilliant, and the inner has the form of the inner part of a brilliant. If they be joined with very pure and strongly refracting varnish, little light is reflected from the separating plane, and their brilliancy is very considerable, though still inferior to a true and deep brilliant. If no varnish be used, much of the light is reflected from the flat side, and the effect of the posterior facets is much diminished. But doublets might be constructed, by making the touching surfaces of a spherical form (of which the curvature should have a due proportion to the size of the stone), that would produce an effect nearly equal to that of the most perfect brilliant.

117 Refraction diminishes as the incident velocity increases.

Cor. 3. Since the change made on the square of the velocity of the incident light is a constant quantity, it follows, that the refraction will diminish as the velocity of the incident light increases. For if L i in fig. 7. be a constant quantity, and EL be increased, it is evident that the ratio of E i, or its equal EF, to EL will be diminished, and the angle LEF, which constitutes the refraction, will be diminished. The physical cause of this is easily seen: When the velocity of the incident light is increased, it employs less time in passing through the refracting stratum or space between the planes ST and KR, and is therefore less influenced by the refracting forces. A similar effect would follow if the transparent body were moving with great velocity towards the luminous body.

Some naturalists have accounted for the different refrangibility

frangibility of the differently coloured rays, by supposing that the red rays move with the greatest rapidity, and they have determined the difference of original velocity which would produce the observed difference of refraction. But this difference would be observed in the eclipses of Jupiter's satellites. They should be ruddy at their immersions, and be some seconds before they attain their pure whiteness; and they should become bluish immediately before they vanish in emersions. This is not observed. Besides, the difference in refrangibility is much greater in flint glass than in crown glass, and this would require a proportionally greater difference in the original velocities. The explanation therefore must be given up.

118

The refraction of a star greater in the evening than in the morning.

It should follow, that the refraction of a star which is in our meridian at six o'clock in the evening should be greater than that of a star which comes on the meridian at six in the morning; because we are moving away from the first, and approaching to the last. But the difference is but $\frac{1}{3000}$ of the whole, and cannot be observed with sufficient accuracy in any way yet practised. A form of observation has been proposed by Dr Blair, professor of practical astronomy in the university of Edinburgh, which promises a very sensible difference of refraction. It is also to be expected, that a difference will be observed in the refraction of the light from the east and western ends of Saturn's ring. Its diameter is about 26 times that of the earth, and it revolves in 10h. 32′; so that the velocity of its edge is about $\frac{1}{10000}$ of the velocity of the sun's light. If therefore the light be reflected from it according to the laws of perfect elasticity, or in the manner here explained, that which comes to us from the western extremity will move more slowly than that which comes from the eastern extremity in the proportion of 2500 to 2501. And if Saturn can be seen distinctly after a refraction of 30° through a prism, the diameter of the ring will be increased one half in one position of the telescope, and will be as much diminished by turning the telescope half round its axis; and an intermediate position will exhibit the ring of a distorted shape. This experiment is one of the most interesting to optical science, as its result will be a severe touchstone of the theories which have been attempted for explaining the phenomena on mechanical principles.

If the tail of a comet be impelled by the rays of the sun, as is supposed by Euler and others, the light by which its extreme parts are seen by us must have its velocity greatly diminished, being reflected by particles which are moving away from the sun with immense rapidity. This may perhaps be discovered by its greater aberration and refrangibility.

119

All light subject to the same laws.

As common day light is nothing but the sun's light reflected from terrestrial bodies, it is reasonable to expect that it will suffer the same refraction. But nothing but observation could assure us that this would be the case with the light of the stars; and it is rather surprising that the velocity of their light is the same with that of the sun's light. It is a circumstance of connexion between the solar system and the rest of the universe. It was as little to be looked for on the light of terrestrial luminaries. If light be conceived as small particles of matter emitted from bodies by the action of accelerating forces of any kind, the vast diversity which we observe in the constitution of sublunary bodies should make us expect differences in this particular. Yet it is found, that the light of a candle, of a glow-worm, &c. suffers the same refraction, and consists of the same colours. This circumstance is adduced as an argument against the theory of emission. It is thought more probable that this sameness of velocity is owing to the nature of the medium, which determines the frequency of its undulations and the velocity of their propagation.

120

Law of refraction when light passes out of one transparent body into another contiguous to it.

Cor. 4. When two transparent bodies are contiguous, the light in its passage out of the one into the other will be refracted towards or from the perpendicular, according as the refracting forces of the second are greater or less than those of the first, or rather according as the area expressing the square of the specific velocity is greater or less. And as the difference of these areas is a determined quantity, the difference between the velocity in the medium of incidence and the velocity in the medium of refraction, will also be a determined quantity. Therefore the sine of the angle of incidence will be in a constant ratio to the sine of the angle of refraction; and this ratio will be compounded of the ratio of the sine of incidence in the first medium to the sine of refraction in a void; and the ratio of the sine of incidence in a void to the sine of refraction in the second medium. If therefore a ray of light, moving through a void in any direction, shall pass through any number of media bounded by parallel planes, its direction in the last medium will be the same as if it had come into it from a void.

Cor. 5. It also follows from these propositions, that if the obliquity of incidence on the posterior surface of a transparent body be such, that the light should be reflected back again, the placing a mass of the same or of another medium in contact with this surface, will cause it to be transmitted, and this the more completely, as the added medium is more dense or more refractive; and the reflection from the separating surface will be the more vivid in proportion as the posterior substance is less dense or of a smaller refractive power. It is not even necessary that the other body be in contact; it is enough if it be so near, that those parts of the refracting strata which are beyond the bodies interfere with or coincide with each other.

All these consequences are agreeable to experience. The brilliant reflection from a dew-drop ceases when it touches the leaf on which it rests: The brilliancy of a diamond is greatly damaged by moisture getting behind it: The opacity of the combined mirror plates, mentioned in Cor. 2. is removed by letting water get between them: A piece of glass is distinctly or clearly seen in air, more faintly when immersed in water, still more faintly amidst oil of olives, and it is hardly perceived in spirits of turpentine. These phenomena are incompatible with the notion that reflection is occasioned by impact on solid matter, whether of the transparent body, or of any ether or other fancied fluid behind it; and their perfect coincidence with the legitimate consequences of the assumed principles, is a strong argument in favour of the truth of those principles.

121

An objection to the Newtonian theory of refraction.

It is worth while to mention here a fact taken notice of by Mr Beguelin, and proposed as a great difficulty in the Newtonian theory of refraction. In order to get the greatest possible refraction, and the simplest measure of the refracting power at the anterior surface of any transparent

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transparent substance, Sir Isaac Newton enjoins us to employ a ray of light falling on the surface *quam obliquissimè*. But Mr Beguelin found, that when the obliquity of incidence in glass was about 89° 50′, no light was refracted, but that it was wholly reflected. He also observed, that when he gradually increased the obliquity of incidence on the superior surface of the glass, the light which emerged last of all did not skim along the surface, making an angle of 90° with the perpendicular, as it should do by the Newtonian theory, but made an angle of more than ten minutes with the posterior surface. Also, when he began with very great obliquities, so that all the light was reflected back into the glass, and gradually diminished the obliquity of incidence, the first ray of light which emerged did not skim along the surface, but was raised about 10 or 15 minutes.

122 Shown to be the necessary consequence of that theory, and of course a confirmation of it.

But all these phenomena are necessary consequences of our principles, combined with what observation teaches us concerning the forces which bodies exert on the rays of light. It is evident, from the experiments of Grimaldi and Newton, that light is both attracted and repelled by solid bodies. Newton's sagacious analysis of these experiments discovered several alternations of actual inflection and deflection; and he gives us the precise distance from the body when some of these attractions end and repulsion commences; and the most remote action to be observed in his experiments is repulsion. Let us suppose this to be the case, although it be not absolutely necessary. Let us suppose that the forces are represented by the ordinates of a curve *a b n p c* which crosses the abscissa in *b*. Draw *b o* parallel to the refracting surface. When the obliquity of incidence of the ray AB has become so great, that its path in the glass, or in the refracting stratum, does not cut, but only touches the line *o b*, it can penetrate no further, but is totally reflected; and this must happen in all greater obliquities. On the other hand, when the ray LE, moving within the glass, has but a very small perpendicular velocity, it will penetrate the refracting stratum no further than till this perpendicular velocity is extinguished, and its path becomes parallel to the surface, and it will be reflected back. As the perpendicular velocity increases by diminishing the obliquity of incidence, it will penetrate farther; and the last reflection will happen when it penetrates so far that its path touches the line *o b*. Now diminish the obliquity by a single second; the light will get over the line *o b*, will describe an arch *o d* B concave upwards, and will emerge in a direction BA, which does not skim the surface, but is sensibly raised above it. And thus the facts observed by M. Beguelin, instead of being an objection against this theory, afford an argument in its favour.

Plate CCCLXXVII. fig. 7.

123 Euler's theory of undulation contrary to fact;

Cor. 6. Those philosophers who maintain the theory of undulation, are under the necessity of connecting the dispersive powers of bodies with their mean refractive powers. M. Euler has attempted to deduce a necessary difference in the velocity of the rays of different colours from the different frequency of the undulations, which he assigns as the cause of their different colorific powers. His reasoning on this subject is of the most delicate nature, and unintelligible to such as are not completely master of the infinitesimal calculus of partial differences, and is unsatisfactory to such as are able to go through its intricacies. It is contradicted by fact. He says, that musical sounds which differ greatly in acuteness are propagated through the air with different velocities: but one of the smallest bells in the chimes of St Giles's church in Edinburgh was struck against the rim of the very deep-toned bell on which the hours are struck. When the sound was listened to by a nice observer at the distance of more than two miles, no interval whatever could be observed. A similar experiment was exhibited to M. Euler himself, by means of a curious instrument used at St Petersburg, and which may be heard at three or four miles distance. But the experiment with the bells is unexceptionable, as the two sounds were produced in the very same instant. This connection between the refrangibility in general and the velocity must be admitted, in its full extent, in every attempt to explain refraction by undulation; and Euler was forced by it to adopt a certain consequence which made a necessary connection between the mean refraction and the dispersion of heterogeneous rays. Confident of his analysis, he gave a deaf ear to all that was told him of Mr Dollond's improvements on telescopes, and asserted, that they could not be such as were related; for an increase of mean refraction must always be accompanied with a *determined* increase of dispersion. Newton had said the same thing, being misled by a limited view of his own principles; but the dispersion assigned by him was different from that assigned by Euler. The dispute between Euler and Dollond was confined to the decision of this question only; and when some glasses made by a German chemist at Petersburg convinced Euler that his determination was erroneous, he did not give up the principle which had forced him to this determination of the dispersion, but immediately introduced a new theory of the achromatic telescopes of Dollond; a theory which took the artists out of the track marked out by mathematicians, and in which they had made considerable advances, and led them into another path, proposing *maxims* of construction hitherto untried, and inconsistent with real improvements which they had already made. The leading principle in this theory is to arrange the different ultimate images of a point which arise either from the errors of a spherical figure or different refrangibility, in a straight line passing through the centre of the eye. The theory itself is specious; and it requires great mathematical skill to accomplish this point, and hardly less to decide on the propriety of the construction which it recommends. It is therefore but little known. But that it is a false theory, is evident from one simple consideration. In the most indistinct vision arising from the worst construction, this rectilineal arrangement of the images obtains completely in that pencil which is situated in the axis, and yet the vision is indistinct. But, what is to our present purpose, this new theory is purely mathematical, suiting any observed dispersive power, and has no connection with the physical theory of undulations, or indeed with any mechanical principles whatever. But, by admitting any dispersive power, whatever may be the mean refraction, all the physical doctrines in his *Nova Theoria Lucis et Colorum* are overlooked, and therefore never once mentioned, although the effects of M. Zeiher's glass are taken notice of as inconsistent with that mechanical proposition of Newton's which occasioned the whole dispute between Euler and Dollond.

124 and misleads artists.

They are indeed inconsistent with the universality of

 that

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that proposition. Newton advances it in his Optics merely as a mathematical proposition highly probable, but says that it will be corrected if *he shall find it* false. The ground on which he *seems* (for he does not expressly say so) to rest its probability, is a limited view of his own principle, the action of bodies on light. He (not knowing any cause to the contrary) supposed that the action of all bodies was similar on the different kinds of light, that is, that the specific velocities of the differently coloured rays had a determined proportion to each other. This was gratuitous; and it might have been doubted by him who had observed the analogy between the chemical actions of bodies by elective attractions and repulsions, and the similar actions on light. Not only have different menstrua unequal actions on their solids, but the order of their affinities is also different. In like manner, we might expect not only that some bodies would attract light in general more than others, but also might differ in the proportion of their actions on the different kinds of light, and this so much, that some might even attract the red more than the violet. The late discoveries in chemistry show us some very distinct proofs, that light is not exempted from the laws of chemical action, and that it is susceptible of chemical combination. The changes produced by the sun's light on vegetable colours, show the necessity of illumination to produce the green fecula; and the aromatic oils of plants, the irritability of their leaves by the action of light, the curious effects of it on the mineral acids, on manganese, and the calces of bismuth and lead, and the imbibition and subsequent emission of it by phosphorescent bodies, are strong proofs of its chemical affinities, and are quite inexplicable on the theory of undulations.

All these considerations taken together, had they been known to Sir Isaac Newton, would have made him expect differences quite anomalous in the dispersive powers of different transparent bodies; at the same time that they would have afforded to his sagacious mind the strongest arguments for the actual emission of light from the luminous body.

Having in this manner established the observed law of refraction on mechanical principles, showing it to be a necessary consequence of the known action of bodies on light, we proceed to trace its mathematical consequences through the various cases in which it may be exhibited to our observation. These constitute that part of the mathematical branch of optical science which is called *dioptrics*.

125
The variation of the intensity of attractions and repulsions unknown.

We are quite unacquainted with the law of action of bodies on light, that is, with the variation of the intensity of the attractions and repulsions exerted at different distances. All that we can say is, that from the experiments and observations of Grimaldi, Newton, and others, light is deflected towards a body, or is attracted by it, at some distances, and repelled at others, and this with a variable intensity. The action may be extremely different, both in extent and force, in different bodies, and change by a very different law with the same change of distance. But, amidst all this variety, there is a certain similarity arising from the joint action of many particles, which should be noticed, because it tends both to explain the similarity observed in the refractions of light, and also its connexion with the phenomena of reflection.

126
The law of variation in the action of many particles different from that of one.
Plate CCCLXXVII. fig. 9.

The law of variation in the joint action of many particles adjoining to the surface of a refracting medium, is extremely different from that of a single particle; but when this last is known, the other may be found out. We shall illustrate this matter by a very simple case. Let DE be the surface of a medium, and let us suppose that the action of a particle of the medium on a particle of light extends to the distance EA, and that it is proportional to the ordinates ED, Ff, Gg, Hh, &c. of the line AhCgfD; that is, that the action of the particle E of the medium on a particle of light in F, is to its action on a particle in H as Ff to Hh, and that it is attracted at F but repelled at H, as expressed by the situation of the ordinates with respect to the abscissa. In the line AE produced to B, make EB, Eχ, E$\varkappa$, Eγ, Eφ, &c. respectively equal to EA, EH, EC, EG, EF, &c.

It is evident that a particle of the medium at B will exert no action on the particle of light in E, and that the particles of the medium in $\varkappa\gamma\varphi$E, will exert on it actions proportional to Hh, Gg, Ff, ED. Therefore, supposing the matter of the medium continuous, the whole action exerted by the row of particles EB will be represented by the area AhCDE; and the action of the particles between B and φ will be represented by the area AhCfF, and that of the particles between E and φ by the area FfDE.

Now let the particle of light be in F, and take Fo =AE. It is no less evident that the particle of light in F will be acted on by the particles in Eo alone, and that it will be acted on in the same manner as a particle in E is acted on by the particles in φB. Therefore the action of the whole row of particles EB on a particle in F will be represented by the area AhCfF. And thus the action on a particle of light in any point of AE will be represented by the area which lies beyond it.

But let us suppose the particles of light to be within the medium, as at φ, and make φd=AE. It is again evident that it is acted on by the particles of the medium between φ and d with a force represented by the area AhCDE, and in the opposite direction by the particles in Eφ with a force represented by the area FfDE. This balances an equal quantity of action, and there remains an action expressed by the area AhCfF. Therefore, if an equal and similar line to AhCDE be described on the abscissa EB, the action of the medium on a particle of light in φ will be represented by the area $\varphi f \varkappa h$B, lying beyond it.

If we now draw a line AKLMRNPB, whose ordinates CK, FQ, φR, &c. are as the areas of the other curve, estimated from A and B; these ordinates will represent the whole forces which are exerted by the particles in EB, on a particle of light moving from A to B. This curve will cut the axis in points L, N such, that the ordinates drawn through them intercept areas of the first curve, which are equal on each side of the axis; and in these points the particle of light sustains no action from the medium. These points are very different from the similar points of the curve expressing the action of a single particle. These last are in the very places where the light sustains the greatest repulsive action

Refraction by Plane Surfaces.

tion of the whole row of particles. In the same manner may a curve be constructed, whose ordinates express the united action of the whole medium.

From these observations we learn in general, that a particle of light within the space of action is acted on with equal forces, and in the same direction, when at equal distances on each side of the surface of the medium.

Sect. II. *Of the focal distance of rays refracted by passing out of one medium into another of different density and through a plane surface.*

Lemma.

The indefinitely small variation of the angle of incidence is to the simultaneous variation of the angle of refraction, as the tangent of incidence is to the tangent of refraction; or, the cotemporaneous variations of the angles of incidence and refraction are proportional to the tangents of these angles.

Plate cclxxvii. fig. 10.

127 Laws of refraction in plane surfaces.

Let RVF, or r V f (fig. 10.) be the progress of the rays refracted at V (the angle r VR being considered in its nascent or evanescent state), and VC perpendicular to the refracting surface VA. From C draw CD, CB perpendicular to the incident and refracted rays RV, VF, cutting r V, V f in δ and β, and let C d, C b be perpendicular to r V, V f.

Because the sines of incidence and refraction are in a constant ratio, their simultaneous variations are in the same constant ratio. Now the angle RV r is to the angle FVf in the ratio of $\frac{B\beta}{BV}$ to $\frac{D\delta}{DV}$; that is, of $\frac{BC}{BV}$ to $\frac{DC}{DV}$; that is, of $\frac{\text{sin. incid.}}{\text{cos. incid.}}$ to $\frac{\text{sin. refr.}}{\text{cos. refr.}}$; that is, of *tan. incid.* to *tan. refr.*

Corollary. The difference of these variations is to the greatest or least of them as the difference of the tangents to the greatest or least tangent.

Problem.

Plate cclxxviii. figs. 1, 2, 3, 4.

Let two rays RV, RP diverge from, or converge to, a point R, and pass through the plane surface PV, separating two refracting mediums AB, of which let B be the most refracting, and let RV be perpendicular to the surface. It is required to determine the point of dispersion or convergence, F, of the refracted rays VD, PE.

Make VR to VG as the sine of refraction to the sine of incidence, and draw GIK parallel to the surface, cutting the incident ray in I. About the centre P, with the radius PI, describe an arch of a circle IF, cutting VR in F; draw PE tending from or towards F. We say PE is the refracted ray, and F the point of dispersion or convergence of the rays RV, RP, or the conjugate focus to R.

For since GI and PV are parallel, and PF equal to PI, we have PF : PR=PI : PR,=VG : VR,=sin. incid. : sin. refr. But PF : PR=sin. PRV : sin. PFV, and RRV is equal to the angle of incidence at P; therefore PFV is the corresponding angle of refraction; FPE is the refracted ray, and F the conjugate focus to R.

Cor. 1. If diverging or converging rays fall on the surface of a more refracting medium, they will diverge or converge less after refraction, F being farther from the surface than R. The contrary must happen when the diverging or converging rays fall on the surface of a less refracting medium, because, in this case, F is nearer to the surface than R.

Cor. 2. Let Rp be another ray, more oblique than RP, the refracting point p being farther from V, and let f p e be the refracted ray, determined by the same construction. Because the arches FI, fi, are perpendicular to their radii, it is evident that they will converge to some point within the angle RIK, and therefore will not cross each other between F and I; therefore R f will be greater than RF, as RF is greater than RG, for similar reasons. Hence it follows, that all the rays which tended from or towards R, and were incident on the whole of VP p, will not diverge from or converge to F, but will be diffused over the line GFf. This diffusion is called aberration from the focus, and is so much greater as the rays are more oblique. No rays flowing from or towards R will have the point of concourse with RV nearer to R than F is: But if the obliquity be inconsiderable, so that the ratio of RP to FP does not differ sensibly from that of RV to FV, the point of concourse will not be sensibly removed from G. G is therefore usually called the *conjugate focus* to R. It is the conjugate focus of an indefinitely slender pencil of rays falling perpendicularly on the surface. The conjugate focus of an oblique pencil, or even of two oblique rays, whose dispersion on the surface is considerable, is of more difficult investigation. See *Gravesande's Natural Philosophy* for a very neat and elementary determination (B).

In a work of this kind, it is enough to have pointed out, in an easy and familiar manner, the nature of optical aberration. But as this is the chief cause of the imperfection of optical instruments, and as the only method of removing this imperfection is to diminish this aberration, or correct it by a subsequent aberration in the opposite direction, we shall here give a fundamental and very simple proposition, which will (with obvious alterations) apply to all important cases. This is the determination of the focus of an infinitely slender pencil of oblique rays RP, Rp.

" Retaining the former construction for the ray PF, (fig. 1.)

(B) We refer to Gravesande, because we consider it of importance to make such a work as ours serve as a general index to science and literature. At the same time we take the liberty to observe, that the focus in question is virtually determined by the construction which we have given: for the points P, F of the line PF are determined, and therefore its position is also determined. The same is true of the position of pf, and therefore the intersection φ of the two lines is likewise determined.

(fig. 1) suppose the other ray R p infinitely near to RP. Draw PS perpendicular to PV, and R r perpendicular to RP, and make P r : PS=VR : VF. On P r describe the semicircle r RP, and on PS the semicircle S ϕ P, cutting the refracted ray PF in ϕ; draw $p\,r$, p S, $p\,\phi$." It follows from the lemma, that if ϕ be the focus of refracted rays, the variation P ϕ p of the angle of refraction is to the corresponding variation PR p of the angle of incidence as the tangent of the angle of refraction VFP to the tangent of the angle of incidence VRP. Now P p may be considered as coinciding with the arch of the semicircles. Therefore the angles PR p, P r p are equal, as also the angles P ϕp, PS p. But PS p is to P r p as P r to PS; that is, as VR to VF; that is, as the cotangent of the angle of incidence to the cotangent of the angle of refraction; that is, as the tangent of the angle of refraction to the tangent of the angle of incidence. Therefore the point ϕ is the focus.

Sect. III. *Of Refraction by Spherical Surfaces.*

Problem.

To find the focus of refracted rays, the focus of incident rays being given.

Plate cccxxviii. figs. 5, 6, &c.

Let PV π (figs. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,) be a spherical surface whose centre is C, and let the incident light diverge from or converge to R. Draw the ray RC through the centre, cutting the surface in the point V, which we shall denominate the *vertex*, while RC is called the *axis*. This ray passes on without refraction, because it coincides with the perpendicular to the surface.

128 The focus of rays refracted by spherical surfaces ascertained.

Let RP be another incident ray, which is refracted at P; draw the radius PC. In RP make RE to RP as the sine of incidence m to the sine of refraction n; and about the centre R, with the distance RE, describe the circle EK, cutting PC in K; draw RK and RF parallel to it, cutting the axis in F. PF is the refracted ray, and F is the focus.

For the triangles PCF, KCR are similar, and the angles at P and K are equal. Also RK is equal to RE, and RPD is the angle of incidence. Now $m:n$=RK : RP, =sin. DPR : sin. RKP, =sin. DPR : sin. CPF. Therefore CPF is the angle of refraction corresponding to the angle of incidence RPD, and PF is the refracted ray, and F the focus. Q. E. D.

Cor. 1. CK : CP=CR : CF, and $\text{CF}=\dfrac{\text{CP}\times\text{CR}}{\text{CK}}$.

Now CP$\times$CR is a constant quantity; and therefore CF is reciprocally as CK, which evidently varies with a variation of the arch VP. Hence it follows, that all the rays flowing from R are not collected at the conjugate focus F. The ultimate situation of the point F, as the point P gradually approaches to, and at last coincides with, V, is called *the conjugate focus of central rays*, and the distance between this focus and the focus of a lateral ray is called *the aberration* of that ray, arising from the spherical figure.

There are, however, two situations of the point R such, that all the rays which flow from it are made to diverge from one point. One of those is C (fig. 5.), because they all pass through without refraction, and therefore still diverge from C; the other is when rays in the rare medium with a convex surface flow from a point R, so situated beyond the centre that CV is to CR as the sine of incidence in the rare medium is to the sine of refraction in the denser, or when rays in the rare medium fall on the convex surface of the denser, converging to F, so situated that CF : CV= $m:n$. In this case they will all be dispersed from F, so situated that CV : CF=$n:m$,=CR : CV for sine RPC : sine PKC=$n:m$, =CR : CP, =sine RPC : sine PRC. Therefore the angle PRC is equal to PKC, or to FPC (by construction of the problem), and the angle C is common to the triangles PRC, FPC; they are therefore similar, and the angles PRC, FPC are equal, and $n:m$= CP : CF, =CK : CR, =CR : CP; therefore CP : CK= CP^2 : CR^2 : but CP and CR are constant quantities, and therefore CK is a constant quantity, and (by the corollary) CF is a constant quantity, and all the rays flowing from R are dispersed from F by refraction. In like manner rays converging to F will by refraction converge to R. This was first observed by Huygens.

Cor. 2. If the incident ray R'P is parallel to the axis KC, we have PO to CO as the sine of incidence to the sine of refraction. For the triangles R'PK'PCO are similar, and PO : CO=R'K' : R'P, =$m:n$. Fig. 5.

Cor. 3. In this case, too, we have the focal distance of central parallel rays reckoned from the vertex = $\dfrac{n}{m-n}\times$VC. For since PO is ultimately VO, we have $m:n$=VO : CO, and $m-n:m$=VO—CO : VO, = VC : VO, and VO=$\dfrac{m}{m-n}\times$VC. This is called the principal focal distance, or focal distance of parallel rays. Also CO, the principal focal distance reckoned from the centre, =$\dfrac{n}{m-n}\times$VC.

N. B. When m is less than n, $m-n$ is a negative quantity.—Also observe, that in applying symbols to this computation of the focal distances, those lines are to be accounted positive which lie from their beginnings, that is, from the vertex, or the centre, or the radiant point, in the direction of the incident rays. Thus when rays diverge from R on the convex surface of a medium, VR is accounted negative and VC positive. If the light passes out of air into glass, m is greater than n; but if it passes out of glass into air, m is less than n. If, therefore, parallel rays fall on the convex surface of glass out of air, in which case $m:n=3:2$ very nearly, we have for the principal focal distance $\dfrac{3}{2-3}$VC, or $+3$ VC. But if it pass out of glass into the convex surface of air, we have VO=$\dfrac{2}{2-3}$VC, or -2 VC; that is, the focus O will be in the same side of the surface with the incident light. In like manner, we shall have for these two cases CO=$+2$VC, and -3VC.

Cor. 4. By construction we have RK : RP=$m:n$

by similarity of triangles	PF : RK=CF : CR
therefore	PF : PR=mCF : nCR
and	mPR$\times$CF=nCR$\times$PF
therefore	mPR : nCR=PF : CF
and	mPR—nCR : mPR=PF—CF : PF
ultimately	mVR—nCR : mVR=VC : VF

This is a very general optical theorem, and affords an easy method for computing the focal distance of refracted rays.

For

Refraction by Spherical Surfaces.

For this purpose let VR, the distance of the radiant point, be expressed by the symbol r, the distance of the focus of refracted rays by the symbol f, and the radius of the spherical surface by a; we have

$$mr - n\overline{r-a} : mr = a : f, \text{ and}$$

$$f = \frac{mar}{mr - n\overline{r-a}}, = \frac{mar}{\overline{m-n}\,r + nd}.$$

In its application due attention must be paid to the qualities of r and a, whether they be positive or negative, according to the conditions of last corollary.

Plate cccLXXVIII. Fig. 8.

Cor. 5. If Q be the focus of parallel rays coming from the opposite side, we shall have RQ : QC=RV : VF. For draw Cq parallel to PF, cutting RP in q; then Rq : qC=RP : PF. Now q is the focus of the parallel rays FP, Cq. And when the point P ultimately coincides with the point V, q must coincide with Q, and we have RQ : QC=RV : VF.

This is the most general optical theorem, and is equally applicable to lenses, or even to a combination of them, as to simple surfaces. It is also applicable to reflections, with this difference, that Q is to be assumed the focus of parallel rays coming the *same* way with the incident rays. It affords us the most compendious methods of computing symbolically and arithmetically the focal distances in all cases.

Cor. 6. We have also Rq : RP=RV : RF, and ultimately for central rays RQ : RV=RV : RF, and RF$=\frac{RV^2}{RQ}$. This proposition is true in lenses and mirrors, but not in single refracting surfaces.

Cor. 7. Also Rq : RC=RP : RF, and ultimately RQ : RV=RC : RF, and RF$=\frac{RV \times RC}{RQ}$. *N.B.* These four points Q, V, C, F, either lie all one way from P, or two of them forward and two backward.

Cor. 8. Also making O the principal focus of rays coming the same way, we have Rq : qC=Co : oF, and ultimately RQ : Qc=cO : OF, and OF$=\frac{QC \times CO}{RQ}$, and therefore reciprocally proportional to RQ, because QC$\times co$ is a constant quantity.

These corollaries or theorems give us a variety of methods for finding the focus of refracted rays, or the other points related to them; and each formula contains four points, of which any three being given, the fourth may be found. Perhaps the last is the most simple, as the quantity $oc+c$Q is always negative, because o and Q are on different sides.

Cor. 9. From this construction we may also derive a very easy and expeditious method of drawing many refracted rays. Draw through the centre C (fig. 15. 16.) a line to the point of incidence P, and a line CA parallel to the incident ray RP. Take VO to VC as the sine of incidence to the sine of refraction, and about A, with the radius VO, describe an arch of a circle cutting PC produced in B. Join AB; and PF parallel to AB is the refracted ray. When the incident light is parallel to RC, the point A coincides with V, and a circle described round V with the distance VO will cut the lines PC, pC, &c. in the points B b. The demonstration is evident.

Having thus determined the focal distance of refracted rays, it will be proper to point out a little more particularly its relation to its conjugate focus of incident rays. We shall consider the four cases of light incident on the convex or concave surface of a denser or a rarer medium.

Fig. 5. to fig. 14.

1. Let light moving in air fall on the convex surface of glass. Let us suppose it tending to a point beyond the glass infinitely distant. It will be collected to its principal focus o beyond the vertex V. Now let the incident light converge a little, so that R is at a great distance beyond the surface. The focus of refracted rays F will be a little within O or nearer to V. As the incident rays are made to converge more and more, the point R comes nearer to V, and the point F also approaches it, but with a much slower motion, being always situated between O and C till it is overtaken by R at the centre C, when the incident light is perpendicular to the surface in every point, and therefore suffers no refraction. As R has overtaken F at C, it now passes it, and is again overtaken by it at V. Now the point R is on the side from which the light comes, that is, the rays diverge from R. After refraction they will diverge from F a little without R; and as R recedes farther from V, F recedes still farther, and with an accelerated motion, till, when R comes to Q, F has gone to an infinite distance, or the refracted rays are parallel. When R still recedes, F now appears on the other side, or beyond V; and as R recedes back to an infinite distance, F has come to O: and this completes the series of variations, the motion of F during the whole changes of situation being in the same direction with the motion of R.

2. Let the light moving in air fall on the concave surface of glass; and let us begin with parallel incident rays, conceiving, as before, R to lie beyond the glass at an infinite distance. The refracted rays will move as if they came from the principal focus O, lying on that side of the glass from which the light comes. As the incident rays are made gradually more converging, and the point of convergence R comes toward the glass, the conjugate focus F moves backward from O; the refracted rays growing less and less diverging, till the point R comes to Q, the principal focus on the other side. The refracted rays growing parallel, or F has retreated to an infinite distance. The incident light converging still more, or R coming between Q and V, F will appear on the other side, or beyond the surface, or within the glass, and will approach it with a retarded motion, and finally overtake R at the surface of the glass. Let R continue its motion backwards (for it has all the while been moving backwards, or in a direction contrary to that of the light); that is, let R now be a radiant point, moving backwards from the surface of the glass. F will at first be without it, but will be overtaken by it at the centre C, when the rays will suffer no refraction. R still receding will get without F; and while R recedes to an infinite distance, F will recede to O, and the series will be completed.

3. Let the light moving in glass fall on the convex surface of air; that is, let it come out of the concave surface of glass, and let the incident rays be parallel, or tending to R, infinitely distant: they will be dispersed by refraction from the principal focus O, within the glass. As they are made more converging, R comes

On Lenses. comes nearer, and F retreats backward, till R comes to Q, the principal focus without the glass; when F is now at an infinite distance within the glass, and the refracted rays are parallel. R still coming nearer, F now appears before the glass, overtakes R at the centre C, and is again overtaken by it at N. R now becoming a radiant point within the glass, F follows it backwards, and arrives at O, when R has receded to an infinite distance, and the series is completed.

4. Let the incident light, moving in glass, fall on the concave surface of air, or come out of the convex surface of glass. Let it tend to a point R at an infinite distance without the glass. The refracted rays will converge to O, the principal focus without the glass. As the incident light is made more converging, R comes towards the glass, while F, setting out from *v*, also approaches the glass, and R overtakes it at the surface V. R now becomes a radiant point within the glass, receding backwards from the surface. F recedes slower at first, but overtakes R at the centre C, and passes it with an accelerated motion to an infinite distance; while R retreats to Q, the principal focus within the glass. R still retreating, F appears before the glass; and while R retreats to an infinite distance, F comes to V, and the series is completed.

Sect. IV. *On Lenses.*

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Lenses, how many. Lenses for optical purposes may be ground into nine different shapes. Lenses cut into five of those shapes, together with their axes, are described in vol. vi. page 33. (See Dioptrics). The other four are,

Plate CCCLXXIX. figs. 1. 2.

1. A *plane glass*, which is flat on both sides, and of equal thickness in all its parts, as EF, fig. 1.
2. A *flat plano-convex*, whose convex side is ground into several little flat surfaces as A, fig. 2.
3. A *prism*, which has three flat sides, and when viewed endwise appears like an equilateral triangle, as B.
4. A *concavo-convex* glass, or *meniscus*, as C, which is seldom made use of in optical instruments.

Fig. 1.

A ray of light G*h* falling perpendicularly on a plane glass EF, will pass through the glass in the same direction *hi*, and go out of it into the air in the same straight line *i* H.

A ray of light AB falling obliquely on a plane glass, will go out of the glass in the same direction, but not in the same straight line: for in touching the glass, it will be refracted into the line BC; and in leaving the glass, it will be refracted in the line CD.

Lemma.

Fig. 3. to 6. There is a certain point E within every double convex or double concave lens, through which every ray that passes will have its incident and emergent parts QA, *a q* parallel to each other: but in a plano-convex or plano-concave lens, that point E is removed to the vertex of the concave or convex surface; and in a meniscus, and in that other concavo-convex lens, it is removed a little way out of them, and lies next to the surface which has the greatest curvature.

For let RE*r* be the axis of the lens joining the centres B, *r* of its surfaces A, *a*. Draw any two of their semidiameters RA, *r a* parallel to each other, and join the point, A, *a*, and the line A *a* will cut the axis in the point E above described. For the triangles REA, *r* E *r* being equiangular, RE will be to E *r* in the given ratio of the semidiameters RA, *ra;* and consequently the point E is invariable in the same lens. Now supposing a ray to pass both ways along the line A *a*, it being equally inclined to the perpendiculars to the surfaces, will be equally bent, and contrariwise in going out of the lens; so that its emergent part AQ *aq* will be parallel. Now any of these lenses will become plano-convex or plano-concave, by conceiving one of the semidiameters RA, *r a* to become infinite, and consequently to become parallel to the axis of the lens, and then the other semidiameter will coincide with the axis; and so the points A, E or *a*, E will coincide. Q. E. D.

Corol. Hence when a pencil of rays falls almost perpendicularly upon any lens, whose thickness is inconsiderable, the course of the ray which passes through E, above described, may be taken for a straight line passing through the centre of the lens without sensible error in sensible things. For it is manifest from the length of A *a*, and from the quantity of the refractions at its extremities, that the perpendicular distance of AQ, *a q*, when produced, will be diminished both as the thickness of the lens and the obliquity of the ray is diminished.

Prop. I.

To find the focus of parallel rays falling almost perpendicularly upon any given lens.

Let E be the centre of the lens, and *r* the centres of its surfaces, R *r* its axis, *g* EG a line parallel to the incident rays upon the surface B, whose centre is R. Parallel to *g* E draw a semidiameter BR, in which produced let V be the focus of the rays after their first refraction at the surface B, and joining *r* let it cut *g* E produced in G, and G will be the focus of the rays that emerge from the lens.

Fig. 7. to 12.

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The focus of parallel rays falling perpendicularly upon any lens.

For since V is also the focus of the rays incident upon the second surface A, the emergent rays must have their focus in some point of that ray which passes straight through this surface; that is, in the line V *r*, drawn through its centre *r*: and since the whole course of another ray is reckoned a straight line *g* EG †, its intersection G with V *r* determines the focus of them all. Q. E. D.

† Corol. from Lemma.

Corol. 1. When the incident rays are parallel to the axis *r* R, the focal distance EF is equal to EG. For let the incident rays that were parallel to *g* E be gradually more inclined to the axis till they become parallel to it; and their first and second foci V and G will describe circular arches NT and GF whose centres are R and E. For the line RV is invariable; being in proportion to RB in a given ratio of the lesser of the sines of incidence and refraction to their difference (by a former proposition); consequently the line EG is also invariable, being in proportion to the given line RV in the given ratio of *r* E to *r* R, because the triangles EG *r*, RV *r* are equiangular.

Corol. 2. The last proportion gives the following rule for finding the focal distance of any thin lens. As R *r*, the interval between the centres of the surfaces, is

Of Lenses. is to r E, the semidiameter of the second surface, so is RV or RT, the continuation of the first semidiameter to the first focus, to EG or EF the focal distance of the lens; which, according as the lens is thicker or thinner in the middle than at its edges, must lie on the same side as the emergent rays, or on the opposite side.

Corol. 3. Hence when rays fall parallel on both sides of any lens, the focal distances EF, Ef are equal. For let rt be the continuation of the semidiameter Er to the first focus t of rays falling parallel upon the surface A; and the same rule that gave rR : rE = RT : EF, gives also rR : RE = rt : Ef. Whence Ef = EF, because the rectangles rE × RT = RE × rt. For rE is to rt and also RE to RT in the same given ratio.

Corol. 4. Hence in particular in a double convex or double concave lens made of glass, it is as the sum of their semidiameters (or in a meniscus as their difference) to either of them, so is double the other, to the focal distance of the glass. For the continuations RT, rt are severally double their semidiameters: because in glass ET : TR and also Et : tr = 3 : 2.

Corol. 5. Hence if the semidiameters of the surfaces of the glass be equal, its focal distance is equal to one of them; and is equal to the focal distance of a plano-convex or plano-concave glass whose semidiameter is as short again. For considering the plane surface as having an infinite semidiameter, the first ratio of the last-mentioned proportion may be reckoned a ratio of equality.

Prop. II.

131 The focus of emergent rays found. Plate CCLXXX. fig. 1. to 6.

The focus of incident rays upon a single surface, sphere, or lens, being given, it is required to find the focus of the emergent rays.

Let any point Q be the focus of incident rays upon a spherical surface, lens, or sphere, whose centre is E; and let other rays come parallel to the line QEq the contrary way to the given rays, and after refraction let them belong to a focus F; then taking Ef equal to EF the lens or sphere, but equal to FC in the single surface, say as QF to FE so Ef to fq; and placing fq the contrary way from f to that of FQ from F, the point q will be the focus of the refracted rays, without sensible error; provided the point Q be not so remote from the axis, nor the surfaces so broad, as to cause any of the rays to fall too obliquely upon them.

For with the centre E and semidiameters EF and Ef describe two arches FG, fg cutting any ray QAaq in G and g, and draw EG and Eg. Then supposing G to be a focus of incident rays (as GA), the emergent rays (as agq) will be parallel to GE*; and on the other hand supposing g another focus of incident rays (as ga), the emergent rays (as AGQ) will be parallel to gE. Therefore the triangles QGE, Egq are equiangular, and consequently QG : GE = Eg : gq; that is, when the ray QAaq is the nearest to QEq, QF : FE = Ef : fg. Now when Q accedes to F and coincides with it, the emergent rays become parallel, that is, q recedes to an infinite distance; and consequently when Q passes to the other side of F, the focus q will also pass through an infinite space from one side of f to the other side of it. Q. E. D.

* By Cor. I. from former Prop.

Corol. 1. In a sphere or lens the focus q may be found by this rule: QF : QE = QE : Qq, to be placed the same way from Q as QF lies from Q.—For let the incident and emergent rays QA, qa be produced till they meet in e; and the triangles QGE, Qeq being equiangular, we have QG : QE = Qe : Qq; and when the angles of these triangles are vanishing, the point e will coincide with E; because in the sphere the triangle Aea is equiangular at the base Aa, and consequently Ae and ae will at last become semidiameters of the sphere. In a lens the thickness Aa is inconsiderable.

The focus may also be found by this rule;—QF : FE = QE : Eq, for QG : GE = QA : Aq.—And then the rule formerly demonstrated for single surfaces holds good for the lenses.

Corol. 2. In all cases the distance fq varies reciprocally as FQ does; and they lie contrariwise from f and F; because the rectangle or the square under EF and Ef, the middle terms in the foregoing proportions, is invariable.

The principal focal distance of a lens may not only be found by collecting the rays coming from the sun, considered as parallel, but also (by means of this proposition) it may be found by the light of a candle or window. For, because Qq : qA = QE : EG, we have (when A coincides with E) Qq : qE = QE : EF; that is, the distance observed between the radiant object and its picture in the focus is to the distance of the lens from the focus as the distance of the lens from the radiant is to its principal focal distance. Multiply therefore the distances of the lens from the radiant and focus, and divide the product by their sum.

Corol. 3. Convex lenses of different shapes that have equal focal distance when put into each others places, have equal powers upon any pencil of rays to refract them to the same focus. Because the rules above mentioned depend only upon the focal distance of the lens, and not upon the proportion of the semidiameters of its surfaces.

Corol. 4. The rule that was given for a sphere of an uniform density, will serve also for finding the focus of a pencil of rays refracted through any number of concentric surfaces, which separate uniform mediums of any different densities. For when rays come parallel to any line drawn through the common centre of these mediums, and are refracted through them all, the distance of their focus from that centre is invariable, as in an uniform sphere.

Corol. 5. When the focuses Q, q lie on the same side of the refracting surfaces, if the incident rays flow from Q, the refracted rays will also flow from q; and if the incident rays flow towards Q, the refracted will also flow towards q: and the contrary will happen when Q and q are on contrary sides of the refracting surfaces. Because the rays are continually going forwards.

From this proposition we also derive an easy method of drawing the progress of rays through any number of lenses ranged on a common axis.

Let A, B, C, be the lenses, and RA a ray incident on the first of them. Let α, β, κ, be their foci for parallel rays coming in the opposite direction; draw the perpendicular αd, cutting the incident ray in d, and draw da through the centre of the lens: AB parallel Fig. 7.

to $d\,a$ will be the ray refracted by the first lens. Through the focus of the second lens draw the perpendicular $\beta\,e$, cutting AB in e; and draw $e\,b$ through the centre of the second lens. BD parallel to $b\,e$ will be the next refracted ray. Through the focus $\varkappa$ of the third lens draw the perpendicular $\varkappa f$, cutting BD in f, and draw $f\,c$ through the centre of the third lens. CE parallel to $f\,c$, will be the refracted ray; and so on.

Sect. V. *On Vision.*

Having described how the rays of light, flowing from objects, and passing through convex glasses, are collected into points, and form the images of external objects; it will be easy to understand how the rays are refracted by the humours of the eye, and are thereby collected into innumerable points on the retina, on which they form the images of the objects from which they flow. For the different humours of the eye, and particularly the crystalline, are to be considered as a convex glass; and the rays in passing through them as affected in the same manner in the one as in the other. A description of the coats and humours, &c. has been given in Anatomy; but it will be proper to repeat as much of the description as will be sufficient for our present purpose.

Plate CCLXXX. fig. 3.

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Description of the eye.

The eye is nearly globular, and consists of three coats and three humours. The part DHHG of the outer coat, is called the *sclerotica;* the rest, DEFG, the *cornea.* Next within this coat is that called the *choroides*, which serves as it were for a lining to the other, and joins with the iris, $m\,n$, $m\,n$. The iris is composed of two sets of muscular fibres; the one of a circular form, which contracts the hole in the middle called the *pupil*, when the light would otherwise be too strong for the eye; and the other of radical fibres, tending everywhere from the circumference of the iris towards the middle of the pupil; which fibres, by their contraction, dilate and enlarge the pupil when the light is weak, in order to let in a greater quantity of it. The third coat is only a fine expansion of the optic nerve L, which spreads like net work all over the inside of the choroides, and is therefore called the *retina;* upon which are thrown the images of all visible objects.

Under the cornea is a fine transparent fluid like water, thence called the *aqueous humour*. It gives a protuberant figure to the cornea, fills the two cavities $m\,m$ and $n\,n$, which communicate by the pupil P; and has the same limpidity, specific gravity, and refracting power, as water. At the back of this lies the crystalline humour II, which is shaped like a double convex glass; and is a little more convex on the back than the fore part. It converges the rays, which pass through it from every visible object to its focus at the bottom of the eye. This humour is transparent like crystal, is of the consistence of hard jelly, and is to the specific gravity of water as 11 to 10. It is enclosed in a fine transparent membrane, called the capsule of the crystalline lens, from which proceed radial fibres $o\,o$, called the *ciliary ligaments*, all around its edge, and join to the circumference of the iris.

At the back of the crystalline, lies the *vitreous* humour KK, which is transparent like glass, and is largest of all in quantity, filling the whole orb of the eye, and giving it a globular shape. It is much of a consistence with the white of an egg, and very little exceeds the specific gravity and refractive power of water.

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The objects on the retina of the eye are inverted.

As every point of an object ABC, sends out rays in all directions, some rays, from every point on the side next the eye, will fall upon the cornea between E and F; and by passing on through the pupil and humours of the eye, they will be converged to as many points on the retina or bottom of the eye, and will form upon it a distinct inverted picture $c\,b\,a$, of the object. Thus, the pencil of rays $q\,r\,s$ that flows from the point A of the object, will be converged to the point a on the retina; those from the point B will be converged to the point b; those from the point C will be converged to the point c; and so of all the intermediate points: by which means the whole image $a\,b\,c$ is formed, and the object made visible; though it must be owned, that the method by which this sensation is conveyed by the optic nerve from the eye to the brain, and there discerned, is above the reach of our comprehension. Fig. 8.

That vision is effected in this manner, may be demonstrated experimentally. Take a bullock's eye whilst it is fresh; and having cut off the three coats from the back part, quite to the vitreous humour, put a piece of white paper over that part, and hold the eye towards any bright object, and you will see an inverted picture of the object upon the paper, or the same thing may be better accomplished by paring the sclerotic coat so thin that it becomes a little transparent, and retains the vitreous humour.

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Why they are seen upright.

Since the image is inverted, many have wondered why the object appears upright. But we are to consider, 1. That *inverted* is only a relative term: and, 2. That there is a very great difference between the real object and the image by which we perceive it. When all the parts of a distant prospect are painted upon the retina, they are all right with respect to one another, as well as the parts of the prospect itself; and we can only judge of an object's being inverted, when it is turned reverse to its natural position with respect to other objects which we see and compare it with.—If we lay hold of an upright stick in the dark, we can tell which is the upper or lower part of it, by moving our hand downward and upward; and know very well that we cannot feel the upper end by moving our hand downward. In the same manner we find by experience, that upon directing our eyes towards a tall object, we cannot see its top by turning our eyes downward, nor its foot by turning our eyes upward; but must trace the object the same way by the eye to see it from head to foot, as we do by the hand to feel it; and as the judgment is informed by the motion of the hand in one case, so it is also by the motion of the eye in the other.

In fig. 9. is exhibited the manner of seeing the same object ABC, by both the eyes D and E at once. Fig. 9.

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An object when viewed with both eyes does not appear double, because the optic nerve is insensible of light.

When any part of the image $c\,b\,a$ falls upon the optic nerve L, the corresponding part of the object becomes invisible. On this account, the optic nerve is wisely placed, not in the middle of the bottom of the eye, but towards the side next the nose; so that whatever part of the image falls upon the optic nerve of one eye, may not fall upon the optic nerve of the other. Thus the point a of the image $c\,b\,a$ falls upon the optic nerve of the eye D, but not of the eye E; and the point

c

Of Vision. *c* falls upon the optic nerve of the eye E, but not of the eye D; and therefore to both eyes taken together, the whole object ABC is visible.

The nearer that any object is to the eye, the larger is the angle under which it is seen, and the magnitude of which it appears. Thus to the eye D, the object ABC is seen under the angle APC; and its image *c b a* is very large upon the retina: but to the eye E, at a double distance, the same object is seen under the angle A*p*C, which is equal only to half the angle APC, as is evident by the figure. The image *c b a* is likewise twice as large in the eye D, as the other image *c b a* is in the eye E. In both these representations, a part of the image falls on the optic nerve, and the object in the corresponding parts is invisible.

Plate CCCLXXXI. fig. 1.

As the sense of seeing is allowed to be occasioned by the impulse of the rays from the visible object upon the retina, and thus forming the image of the object upon it, and that the retina is only the expansion of the optic nerve all over the choroides; it should seem surprising, that the part of the image which falls on the optic nerve should render the like part of the object invisible; especially as that nerve is allowed to be the instrument by which the impulse and image are conveyed to the common sensory in the brain.

136 Proved by experiment. Fig. 2.

That part of the image which falls upon the middle of the optic nerve is lost, and consequently the corresponding part of the object is rendered invisible, is plain by experiment. For if a person fixes three patches, A, B, C, (fig. 2.) upon a white wall, at the height of the eye, and at the distance of about a foot from each other, and places himself before them, shutting the right eye, and directing the left towards the patch C, he will see the patches A and C, but the middle patch B will disappear. Or, if he shuts his left eye, and directs the right towards A, he will see both A and C, but B will disappear; and if he directs his eye towards B, he will see both B and A, but not C. For whatever patch is directly opposite to the optic nerve N, vanishes. This requires a little practice; after which he will find it easy to direct his eye so as to lose the sight of whatever patch he pleases.

137 Dispute concerning the seat of vision.

This experiment, first tried by M. Marriotte, occasioned a new hypothesis concerning the seat of vision, which he supposed not to be in the retina, but in the choroides. An improvement on the experiment was afterwards made by M. Picard, who contrived that an object should disappear when both the eyes were kept open. He fastened upon a wall a round white paper, an inch or two in diameter; and by the side of it he fixed two marks, one on the right hand, and the other on the left, each at about two feet distance from the paper, and somewhat higher. He then placed himself directly before the paper, at the distance of nine or ten feet, and putting the end of his finger over against both his eyes, so that the left-hand mark might be hid from the right eye, and the right-hand mark from the left eye. Remaining firm in this posture, and looking steadily, with both eyes, on the end of his finger, the paper which was not at all covered by it would totally disappear. This, he says, is the more surprising, because, without this particular encounter of the optic nerves, where no vision is made, the paper will appear double, as is the case when the finger is not rightly placed.

M. Marriotte observes, that this improvement on his experiment, by M. Picard, is ingenious, but difficult to execute, since the eyes must be considerably strained in looking at any object so near as four inches; and proposes another not less surprising, and more easy. Place, says he, on a dark ground, two round pieces of white paper, at the same height, and three feet from one another; then stand opposite to them, at the distance of 12 or 13 feet, and hold your thumb before your eyes, at the distance of about eight inches, so that it may conceal from the right eye the paper that is to the left hand, and from the left eye the paper to the right hand. Then, if you look at your thumb steadily with both eyes, you will lose sight of both the papers; the eyes being so disposed, that each of them receives the image of one of the papers upon the base of the optic nerve, while the other is intercepted by the thumb. Of Vision.

M. Le Cat pursued this curious experiment a little farther than M. Marriotte. In the place of the second paper, he fixed a large white board, and observed, that at a proper distance he lost sight of a circular space in the centre of it. He also observed the size of the paper which is thus concealed from the sight, corresponding to several distances, which enabled him to ascertain several circumstances relating to this part of the structure of the eye more exactly than had been done before.

The following is the manner in which this curious experiment is now generally made. Let three pieces of paper be fastened upon the side of a room, about two feet asunder; and let a person place himself opposite to the middle paper, and, beginning near to it, retire gradually backwards, all the while keeping one of his eyes shut, and the other turned obliquely towards that outside paper which is towards the covered eye, and he will find a situation (which is generally at about five times the distance at which the papers are placed from one another), when the middle paper will entirely disappear, while the two outermost continue plainly visible; because the rays which come from the middle paper will fall upon the retina where the optic nerve is inserted.

It is not surprising that M. Marriotte was led, by this remarkable observation, to suspect that the retina was the seat of vision. He not only did so; but, in consequence of attentively considering the subject, a variety of other arguments in favour of the choroides occurred to him, particularly his observation, that the retina is transparent, as well as the crystalline and other humours of the eye, which he thought could only enable it to transmit the rays farther; and he could not persuade himself that any substance could be considered as being the termination of the pencils and the proper seat of vision, at which the rays are not stopped in their progress.

He was farther confirmed in his opinion of the small degree of sensibility in the retina, and of the greater sensibility of the choroides, by observing that the pupil dilates itself in the shade, and contracts itself in a great light; which involuntary motion, he thought, was a clear proof that the fibres of the iris are extremely sensible to the action of light; and this part of the eye is only a continuation of the choroides. He also thought that the dark colour of the choroid coat was intended to make it more susceptible of the impression of light.

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M. Pecquet, in answer to M. Marriotte's observation concerning the transparency of the retina, says, that it is very imperfectly so, resembling only oiled paper, or the horn that is used for lanterns; and besides, that its whiteness demonstrates it to be sufficiently opaque for stopping the rays of light, as much as is necessary for the purpose of vision; whereas, if vision be performed by means of those rays which are transmitted through such a substance as the retina, it must be very indistinct. The retina resembles very much the thin white film which intervenes between the white of an egg and its shell.

As to the blackness of the choroides, which M. Marriotte thought to be necessary for the purpose of vision, M. Pecquet observes, that it is not the same in all eyes, and that there are very different shades of it among the individuals of mankind, as also among birds, and some other animals, whose choroides is generally black; and that in the eyes of lions, camels, bears, oxen, stags, sheep, dogs, cats, and many other animals, that part of the choroides which is the most exposed to light, very often exhibits colours as vivid as those of mother-of-pearl, or of the iris. He admits that there is a defect of vision at the insertion of the optic nerve; but he thought that it was owing to the blood-vessels of the retina, the trunks of which are so large in that place as to obstruct all vision.

To M. Pecquet's objection, founded on the opacity of the retina, M. Marriotte replies, that there must be a great difference betwixt the state of that substance in living and dead subjects; and as a further proof of the transparency of the retina, and the power of the choroides beyond it to reflect light, he says, that if a lighted candle be held near to a person's eyes, and a dog, at the distance of eight or ten steps, be made to look at him, he would see a bright light in the dog's eyes, which he thought to proceed from the reflection of the light of the candle from the choroides of the dog, since the same appearance cannot be produced in the eyes of men, or other animals, whose choroides is black.

M. Marriotte observes, in opposition to Pecquet's remark concerning the blood-vessels of the retina, that they are not large enough to prevent vision in every part of the base of the nerve, since the diameter of each of the two vessels occupies no more than $\frac{1}{5}$th part of it. Besides, if this were the cause of this want of vision, it would vanish gradually, and the space to which it is confined would not be so exactly terminated as it appears to be.

We must add, that M. Pecquet also observed, that notwithstanding the insensibility of the retina at the insertion of the optic nerve when the light is only moderate; yet luminous objects, such as a bright candle placed at the distance of four or five paces, do not absolutely disappear, in the same circumstances in which a white paper would; for this strong light may be perceived though the picture fall on the base of the nerve.

Dr Priestley, however, found that a large candle made no impression on that part of his eye, though by no means able to bear a strong light.

The common opinion was also favoured by the anatomical description of several animals by the members of the French academy, and particularly their account of the sea calf and porcupine; in both of which the optic nerve is inserted in the very axis of the eye, exactly opposite to the pupil, which was thought to leave no room to doubt, but that in these animals the retina is perfectly sensible to the impression of light at the insertion of the nerve.

M. De la Hire took part with M. Pecquet, arguing in favour of the retina from the analogy of the senses, in all of which the nerves are the proper seat of sensation. This philosopher, however, supposed that the choroid coat receives the impressions of images, in order to transmit them to the retina.

M. Perrault also took the part of M. Pecquet against M. Marriotte, and in M. Perrault's works we have several letters that passed between these two gentlemen upon this subject.

This dispute was revived by an experiment of M. Mery, recorded in the memoirs of the French Academy for 1704. He plunged a cat in water, and exposing her eye to the strong light of the sun, observed that the pupil was not at all contracted by it; whence he concluded, that the contraction of the iris is not produced by the action of the light. For he contended that the eye receives more light in this situation than in the open air. At the same time he thought he observed that the retina of the cat's eye was transparent, and that he could see the opaque choroides beyond it; from which he concludes, that the choroides is the substance intended to receive the rays of light, and to be the chief instrument of vision. But M. De la Hire, in opposition to this argument of M. Mery, endeavours to show that fewer rays enter the eye under water, and that in those circumstances it is not so liable to be affected by them. Besides, it is obvious, that the cat must be in great terror in this situation; and being an animal that has a very great voluntary power over the muscles of the iris, and being now extremely attentive to every thing about her, she might keep her eye open notwithstanding the action of the light upon it, and though it might be very painful to her. We are informed, that when a cat is placed in a window through which the sun is shining, and consequently her iris nearly closed, if she hear a rustling, like that which is made by a mouse, on the outside of the window, she will immediately open her eyes to their greatest extent, without in the least turning her face from the light.

M. Le Cat took the side of M. Marriotte in this controversy, it being peculiarly agreeable to his general hypothesis, viz. that the pia mater, of which the choroides is a production, and not the nerves themselves, is the proper instrument of sensation. He thought that the change which takes place in the eyes of old people (the choroides growing less black with age) favoured his hypothesis, as they do not see with the same distinctness as young persons. M. Le Cat supposed that the retina answers a purpose similar to that of the scarf-skin, covering the papillæ pyramidales, which are the immediate organs of feeling, or that of the porous membrane which covers the glandulous papillæ of the tongue. The retina, he says, receives the impression of light, moderates it, and prepares it for its proper organ, but is not itself sensible of it.

It must be observed, that M. Le Cat had discovered that the pia mater, after closely embracing the optic nerve, at its entrance into the eye, divides into two branches, one of which closely lines the cornea, and at length is lost in it, while the second branch forms what is

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is called the *choroides*, or *uvea*. He also showed that the sclerotic coat is an expansion of the dura mater: and he sent dissections of the eye to the Royal Academy of Sciences in 1739, to prove these assertions, and several others contrary to the opinions of the celebrated Winslow, which he had advanced in his *Traité de Sens*.

To these arguments in favour of the choroides, we may add the following given by Mr Michell.

In order that vision be distinct, the pencils of rays which issue from the several points of any object, must be collected either accurately, or at least very nearly, to corresponding points in the eye, which can only be done upon some uniform surface. But the retina being of a considerable thickness, and the whole of it being uniformly nervous, and at least nearly, if not perfectly, transparent, presents no particular surface; so that, in whatever part of it the pencils be supposed to have their foci, the rays belonging to them will be separated from one another, either before or after they arrive there, and consequently vision would be confused.

If we suppose the seat of vision to be at the interior surface of the retina, and the images of objects to be formed by direct rays, a considerable degree of confusion could not but arise from the light reflected by the choroides, in those animals in which it is white, or coloured. On the other hand, it would be impossible that vision should be performed at this place by light reflected from the choroides, because in many animals it is perfectly black; and yet such animals see even more distinctly than others.

If the seat of vision be at the farther surface of the retina, and if vision be performed by direct rays, a white choroid coat could be of no use; and if it were by reflected rays, a black one could not answer the purpose.

It is likewise an argument in favour of the choroides being the organ of vision, that it is a substance which receives a more distinct impression from the rays of light than any other membrane in any part of the animal system, excepting, perhaps, that white cuticle which lies under the scales of fishes: whereas the retina is a substance on which the light makes an exceedingly faint impression, and perhaps no impression at all; since light in passing out of one transparent medium into another immediately contiguous to it, suffers no refraction or reflection, nor are any of the rays absorbed unless there is some difference in the refracting power of the two media, which probably is not the case between the retina and the vitreous humour which is in contact with it: And wherever the light is not affected by the medium on which it falls, we can hardly suppose the medium to receive any impression from the light, the action being probably always mutual and reciprocal.

Besides, the retina is so situated, as to be exposed to many rays besides those which terminate in it, and which, therefore, cannot be subservient to vision, if it be performed there. Now this is not the case with the choroides, which is in no shape transparent, and has no reflecting substance beyond it.

It is, besides, peculiarly favourable to the opinion of Marriotte, that we can then see a sufficient reason for the diversity of its colour in different animals, according as they are circumstanced with respect to vision. In all terrestrial animals, which use their eyes by night, the choroides is either of a bright white, or of some very vivid colour, which reflects the light very strongly. On this account vision may be performed with less light, but it cannot be with great distinctness, the reflection of the rays doubling their effect, since it must extend over some space, all reflection being made at a distance from the reflecting body. Besides, the choroides in brutes is not in general perfectly white, but inclined to blue; and is therefore, probably, better adapted to see by the fainter coloured light, which chiefly prevails in the night; and we would add, is on the same account more liable to be strongly impressed by the colours to which they are chiefly exposed.

On the other hand, the choroides of birds in general, especially eagles, hawks, and other birds of prey, is black; by which means they are able to see with the greatest distinctness, but only in bright day light. The owl, however, seeking her food by night, has the choroides white like that of a cat. In the eyes of man, which are adapted to various uses, the choroides is neither so black as that of birds, nor so white as that of those animals who make the greatest use of their eyes in the night.

As to a third hypothesis, which is in effect that of M. de la Hire, and which makes both the retina and the choroides equally necessary to vision, and supposes it to be performed by the impression of light on the choroides communicated to the retina; Mr Michell observes, that the perceptions can hardly be supposed to be so acute, when the nerves do not receive the impressions immediately, but only after they have been communicated to another substance. Besides, it must be more natural to suppose, that, when the principal impression is made upon the choroides, it is communicated to the brain by its own nerves, which are sufficient for the purpose.

138 Dimensions of the spot in the eye where there is no vision. Plate CCCLXXXII. fig. 3.

The dimensions and precise form of the spot in the eye in which there is no vision, were more accurately calculated by Daniel Bernouilli, in the following manner. He placed a piece of money, O, upon the floor; and then shutting one of his eyes, and making a pendulum to swing, so that the extremity of it might be nearly in the line AO, he observed at what place C it began to be invisible, and where it again emerged into view at A. Raising the pendulum higher and lower, he found other points, as H, N, P, G, B, at which it began to be invisible; and others, as M, L, E, A, at which it began to be visible again; and drawing a curve through them, he found that it was elliptical; and, with respect to his own eye, the dimensions of it were as follow; OC was 23, AC 10, BD 3, DH 13, and EG 14; so that the centre being at F, the greater axis was to the less as 8 to 7.

From these *data* the plane on which the figure was drawn being obliquely situated with respect to the eye, he found, that the place in the eye that corresponded to it was a circle, the diameter of which was a seventh part of the diameter of the eye, the centre of it being 27 parts of the diameter from the point opposite to the pupil, a little above the middle. In order, therefore, that this space in which there is no vision may be as small as possible, it is necessary that the nerve should enter the eye perpendicularly, and that both this end, and also its entering the eye at a distance from its axis, are gained by the particular manner in which the two optic nerves

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In support of one of the observations of Mr Michell, Dr Priestley observes, that Aquapendente mentions the case of a person at Pisa, who could see very well in the night, but very little or none at all in the day time. This is also said to be the case with those white people among the blacks of Africa, and the inhabitants of the isthmus of America, who, from this circumstance, are called *moon-eyed*. Dr Priestley thinks it probable that their choroides is not of a dark colour, as it is in others of the human species; but white or light-coloured, as in those animals which have most occasion for their eyes in the night.

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Arguments for the retina's being the seat of vision.

Dr Porterfield observes, that the reason why there is no vision at the entrance of the optic nerve into the eye, may be its want of that softness and delicacy which it has when it is expanded upon the choroides; and that, in those animals in which that nerve is inserted in the axis of the eye, it is observed to be equally delicate, and therefore probably equally sensible, in that place as in any other part of the retina. In general, the nerves, when embraced by their coats, have but little sensibility in comparison of what they are endued with when they are divested of them, and unfolded in a soft and pulpy substance.

Haller observes, that the choroides cannot be universally the seat of vision, because, sometimes in men and birds, but especially in fishes, it is covered internally with a black mucus, through which the rays cannot penetrate. This writer speaks of a fibrous membrane in the retina distinct from its pulpy substance. On these fibres, he conjectures, that the images of objects are painted.

M. De la Hire's argument in favour of the retina, from the analogy of the senses, is much strengthened by considering that the retina is a large nervous apparatus, immediately exposed to the impression of light; whereas the choroides receives but a slender supply of nerves, in common with the sclerotica, the conjunctiva, and the eyelids, and that its nerves are much less exposed to the light than the naked fibres of the optic nerve.

That the optic nerve is of principal use in vision, is farther probable from several phenomena attending some of the diseases of the eye. When an amaurosis has affected one eye only, the optic nerve of that eye has been found manifestly altered from its sound state. Dr Priestley was present when Mr Hey examined the brain of a young girl, who had been blind of one eye, and saw that the optic nerve belonging to it was considerably smaller than the other; and he informed him, that upon cutting into it, it was much harder, and cineritious. Morgagni mentions two cases, in one of which he found the optic nerves smaller than usual, and of a cineritious colour, when, upon inquiry, he was informed that the person had not been blind, though there might have been some defect in the sight of one of the eyes. In the other case, only one of the optic nerves was affected in that manner, and the eye itself was in other respects very perfect. Here, also, he was expressly told, that the person was not blind of that eye.

Besides, as the optic nerve is solely spent in forming the retina, so no function of the eye not immediately subservient to vision, is affected by an amaurosis. On the contrary, those nerves which go to the choroides are found to retain, in this disease, their natural influence. The iris will contract in a recent gutta serena of one eye, if the other remains sound, and is suddenly exposed to a strong light. The sclerotica, conjunctiva, and eyelids, which receive their nerves from the same branches as the choroides, retain their sensibility in this disorder.

The manner in which persons recover from an amaurosis, favours the supposition of the seat of vision being in the retina: since those parts which are the most distant from the insertion of the nerve, recover their sensibility the soonest, being in those places the most pulpy and soft; whereas there is no reason to think that there is any difference in this respect in the different parts of the choroides. Mr Hey has been repeatedly informed, by persons labouring under an imperfect amaurosis, or gutta serena, that they could not, when looking at any object with one eye, see it so distinctly when it was placed in the axis of the eye, as when it was situated out of the axis. And those persons whom he had known to recover from a perfect amaurosis, first discovered the objects whose images fell upon that part of the retina which is at the greatest distance from the optic nerve.

We shall conclude these remarks with observing, that if the retina be as transparent as it is generally represented to be, so that the termination of the pencils must necessarily be either upon the choroides, or some other opaque substance interposed between it and the retina, the action and reaction occasioned by the rays of light being at the common surface of this body and the retina, both these mediums (supposing them to be equally sensible to light) may be equally affected; but the retina, being naturally much more sensible to this kind of impression, may be the only instrument by which the sensation is conveyed to the brain, though the choroides, or the black substance with which it is sometimes lined, may also be absolutely necessary to vision. This is not far from the hypothesis of M. de la Hire, and will completely account for the entire defect of vision at the insertion of the optic nerve. 140

Of bright and obscure, distinct and indistinct vision.

Vision is distinguished into *bright* and *obscure*, *distinct* and *indistinct*.—It is said to be *bright*, when a sufficient number of rays enter the pupil at the same time; *obscure*, when too few. It is *distinct* when each pencil of rays is collected into a focus exactly upon the retina; *indistinct*, when they meet before they come at it, or when they would pass it before they meet; for, in either of these last cases, the rays flowing from different parts of the object will fall upon the same part of the retina, which must necessarily render the image indistinct.—Now, that objects may appear with a due brightness, whether more or fewer rays proceed from them, we have a power of contracting or dilating the pupil, by means of the muscular fibre of the iris, in order to take in a greater or smaller number of rays. But this power has its limits. In some animals it is much greater than in others; particularly in such as are obliged to seek their food by night as well as by day, as in cats, &c. 141

Of distinct vision at different distances.

In order that the rays be collected into points exactly upon the retina, that is, in order that objects may appear *distinct*, whether they be nearer or farther off, i. e. whether the rays proceeding from them diverge more or less

less, some change must necessarily take place in the eye. The nature of this change has been a subject of great dispute among philosophers. While some have maintained, that the eye accommodates itself to different distances, by the muscular power of the ciliary ligament, which makes the crystalline lens approach to, or recede from, the retina; others are of opinion, that the form of the crystalline is altered by the ciliary ligament, or by the muscular power of the laminæ of which it is composed. M. de la Hire supposes, that the eye is adapted to various distances by the contraction and dilatation of the pupil; and Dr Monro imagines, that its effect is produced by the pressure of the orbicular muscles upon the upper and under parts of the cornea, or by the action of the recti muscles, which elongate the axis of the eye, by pressing chiefly upon the sides of the eyeballs.—This subject has lately been accurately examined by Mr Ramsden, and Mr Everard Home, who found, that the adjustment of the eye is effected by three changes in the organ: 1. By an increase of curvature in the cornea, occasioned by the action of the recti muscles, which produces $\frac{1}{3}$ of the effect. 2. By an elongation of the eyeball; and, 3. By a motion of the crystalline lens.

142 **Of short-sighted and long-sighted people.**

In those eyes where the cornea is very protuberant, the rays of light suffer a considerable refraction at their entrance into the aqueous humour, and are therefore collected into a focus before they fall upon the retina, unless the object be placed very near, so that the rays which enter the eye may have a considerable degree of divergency. People that have such eyes are said to be *purblind*. Now, since the nearer an object is to the eye, the greater is its image, these people can see much smaller objects than others, as they see much nearer ones with the same distinctness; and their sight continues good longer than that of other people, because the cornea, as they grow old, becomes less protuberant, from the want of that redundancy of humours with which they were filled before. On the contrary, old men having the cornea of their eyes too flat, for want of a sufficient quantity of the aqueous humour, if the rays diverge too much before they enter the eye, they cannot be brought to a focus when they reach the retina: on which account those people cannot see distinctly, unless the object be situated at a greater distance from the eye than is required for those whose eyes are of a due form. The latter require the assistance of convex glasses to make them see objects distinctly; the former of concave ones. For if either the cornea *a b c*, (fig. 4). or crystalline humour *e*, or both of them, be too flat, as in the eye A, their focus will not be on the retina as at A, where it ought to be, in order to render vision distinct; but beyond the eye, as at *f*. This is remedied by placing a convex glass *g h* before the eye, which makes the rays converge sooner, and forms the image exactly on the retina at *d*. Again, If either the cornea, or crystalline humour, or both of them, be too convex, as in the eye B, the rays that enter it from the object C will be converged to a focus in the vitreous humour, as at *f*; and by diverging from thence to the retina, will form a very confused image upon it; so that the observer will have as confused a view of the object as if his eye had been too flat. This inconvenience is remedied by placing a concave glass *g h* before the eye; which glass, by causing the rays to diverge between it and the eye, lengthens the focal distance, and makes the rays unite at the retina, and form a distinct image of the object.

Plate CCCLXXXI. fig. 4.

143 **Of the least angle of vision.**

Such eyes as are of a proper convexity, cannot see any object distinctly at less distance than six inches; and there are numberless objects too small to be seen at that distance, because they cannot appear under any sensible angle.—Concerning the least angle under which any object is visible, there was a debate between Dr Hooke and Hevelius. The former asserted that no object could well be seen if it subtended an angle less than one minute; and, if the object be round as a black circular spot upon a white ground, or a white circle upon a black ground, it follows, from an experiment made by Dr Smith, that this is near the truth; and from this he calculates, that the diameter of the picture of such least visible point upon the retina is the 8000th part of an inch; which he therefore calls a *sensible point of the retina*. On the other hand, Mr Courtivron found, by experiment, that the smallest angle of vision was 40 seconds. According to Dr Jurin, there are cases in which a much smaller angle than one minute can be discerned by the eye; and he observes, that in order to our perceiving any impression upon our senses, it must either be of a certain degree of force, or of a certain degree of magnitude. For this reason, a star, which appears only as a lucid point through a telescope subtending not so much as an angle of one second, is visible to the eye;

144 **Lines can be seen under smaller angles than spots, and why.**

though a white or black spot of 25 or seconds, is not perceptible. Also a line of the same breadth with the circular spot will be visible at such a distance as the spot is not to be perceived at: because the quantity of impression from the line is much greater than that from the spot; and a longer line is visible at a greater distance than a shorter one of the same breadth. He found by experience, that a silver wire could be seen when it subtended an angle of three seconds and a half; and that a silk thread could be seen when it subtended an angle of two seconds and a half.

This greater visibility of a line than of a spot seems to arise only from the greater quantity of the impression; but without the limits of perfect vision, Dr Jurin observes, that another cause concurs, whereby the difference of visibility between the spot and the line is rendered much more considerable. For the impression upon the retina made by the line is then not only much greater, but also much stronger, than that of the spot; because the faint image, or penumbra, of any one point of the line, when the hole is placed beyond the limits of distinct vision, will fall within the faint image of the next point, and thereby much increase the light that comes from it.

In some cases Dr Jurin found the cause of indistinct vision to be the unsteadiness of the eye; as our being able to see a single black line upon a white ground or a single white line upon a black ground, and not a white line between two black ones on a white ground. In viewing either of the former objects, if the eye be imperceptibly moved, all the effect will be, that the object will be painted upon a different part of the retina; but wherever it is painted, there will be but one picture, single and uncompounded with any other. But in viewing the other, if the eye fluctuate ever so little, the image of one or other of the black lines will be so shifted to that part of the retina which was before possessed by

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by the white line; and this must occasion such a dazzling in the eye, that the white line cannot be distinctly perceived, and distinguished from the black lines; which by a continual fluctuation, will alternately occupy the space of the white line, whence must arise an appearance of one broad dark line, without any manifest separation.

By trying this experiment with two pins of known diameter, set in a window against the sky light, with a space between them equal in breadth to one of the pins, he found that the distance between the pins could hardly be distinguished when it subtended an angle of less than 40 seconds, though one of the pins alone could be distinguished when it subtended a much less angle. But though a space between two pins cannot be distinguished by the eye when it subtends an angle less than 40 seconds, it does not follow that the eye must necessarily commit an error of 40 seconds in estimating the distance between two pins when they are much farther from one another. For if the space between them subtend an angle of one minute, and each of the pins subtend an angle of four seconds, which is greater than the least angle the eye can distinguish, it is manifest that the eye may judge of the place of each pin within two seconds at the most; and consequently the error committed in taking the angle between them cannot at the most exceed four seconds, provided the instrument be sufficiently exact. And yet, says he, upon the like mistake was founded the principal objection of Dr Hooke against the accuracy of the celestial observations of Hevelius.

A black spot upon a white ground, or a white spot upon a black ground, he says, can hardly be perceived by the generality of eyes when it subtends a less angle than one minute. And if two black spots be made upon white paper, with a space between them equal in breadth to one of their diameters, that space is not to be distinguished, even within the limits of perfect vision, under so small an angle as a single spot of the same size. To see the two spots distinctly, therefore, the breadth of the space between them must subtend an angle of more than a minute. It would be difficult, he says, to make this experiment accurately, within the limits of perfect vision; because the objects must be extremely small: but by a rude trial, made with square bits of white paper, placed upon a black ground, he judged, that the least angle under which the interval of two objects could be perceived, was at least a fourth part greater than the least angle under which a single object can be perceived. So that an eye which cannot perceive a single object under a smaller angle than one minute, will not perceive the interval between two such objects under a less angle than 75 seconds.

Without the limits of perfect vision, the distance at which a single object ceases to be perceptible will be much greater in proportion than the distance at which a space of equal breadth between two such objects ceases to be perceptible. For, without these limits, the image of each of the objects will be attended with a penumbra, and the penumbra of the two near objects will take up part of the space between them, and thus render it less perceptible; but the penumbra will add to the breadth of the single object, and will thereby make it more perceptible, unless its image be very faint. Upon the same principles he likewise accounts for the radiation of the stars, whereby the light seems to project from them different ways at the same time.

Mr Mayer made many experiments in order to ascertain the smallest angle of vision in a variety of respects. He began with observing at what distance a black spot was visible on white paper; and found, that when it could barely be distinguished, it subtended an angle of about 34 seconds. When black lines were disposed with intervals broader than themselves, they were distinguished at a greater distance than they could be when the objects and the intervals were equal in breadth. In all these cases it made no difference whether the objects were placed in the shade or in the light of the sun; but when the degrees of light were small, their differences had a considerable effect, though by no means in proportion to the differences of the light. For if an object was illuminated to such a degree as to be just visible at the distance of nine feet, it would be visible at the distance of four feet, though the light was diminished above 160 times. It appeared in the course of these experiments, that common daylight is, at a medium, equal to that of 25 candles placed at the distance of one foot from the object.

145 Of single vision with two eyes.

As an image of every visible object is painted on the retina of each of our eyes, it thence becomes a natural question, Why we do not see every thing double? It was the opinion of Sir Isaac Newton and others, that objects appear single, because the two optic nerves unite before they reach the brain. But Dr Porterfield shows, from the observation of several anatomists, that the optic nerves do not mix, or confound their substance, being only united by a close cohesion; and objects have appeared single where the optic nerves were found to be disjoined.

146 Solutions of this difficulty by Dr Briggs.

Dr Briggs supposed that single vision was owing to the equal tension of the corresponding parts of the optic nerves, whereby they vibrated in a synchronous manner. But, besides several improbable circumstances in this account, Dr Porterfield shows that facts do by no means favour it.

To account for this phenomenon, this ingenious writer supposes, that by an original law in our natures, we imagine objects to be situated somewhere in a right line drawn from the picture of it upon the retina, through the centre of the pupil. Consequently, the same object appearing to both eyes to be in the same place, the mind cannot distinguish it into two. In answer to an objection to this hypothesis, from objects appearing double when one eye is distorted, he says the mind mistakes the position of the eye, imagining that it had moved in a manner corresponding to the other, in which case the conclusion would have been just.

147 Dr Porterfield.

This principle, however, has been thought sufficient to account for this appearance. Originally, every object, making two pictures, is imagined to be double; but by degrees, we find, that when two corresponding parts of the retina are impressed, the object is but one; but if those corresponding parts be changed, by the distortion of one of the eyes, the object must again appear double as at the first. This has been thought verified by Mr Cheselden; who informs us, that a gentleman, who from a blow on his head had one eye distorted, found every object to appear double; but by degrees the

Of Vision. the most familiar ones came to appear single again, and in time all objects did so, without any amendment of the distortion.

148 Dr Reid, and

On the other hand, Dr Reid is of opinion, that the correspondence of the centres of the two eyes, on which single vision depends, does not arise from custom, but from some natural constitution of the eye and of the mind. He makes several just objections to the case of Mr Forster, recited by Dr Smith and others; and thinks that the case of the young man couched by Cheselden, who saw singly with both eyes immediately upon receiving his sight, is nearly decisive in proof of his supposition. He also found that three young gentlemen, whom he endeavoured to cure of squinting, saw objects singly, as soon as ever they were brought to direct the centres of both their eyes to the same object, though they had never been used to do so from their infancy; and he observes, that there are cases, in which, notwithstanding the fullest conviction of an object being single, no practice of looking at it will ever make it appear so, as when it is seen through a multiplying glass.

To all these solutions of the difficulty respecting single vision by both eyes, objections have been lately made which seem insurmountable. By judicious experiments, Dr Wells has shown, that it is neither by custom alone, nor by the original property of the eyes alone, that objects appear single; and having demolished the theories of others, he thus endeavours to account for the phenomenon.

149 Dr Wells.

"The visible place of an object being composed of its visible distance and visible direction, to show how it may appear the same to both eyes, it will be necessary (says he*) to explain in what manner the distance and direction, which are perceived by one eye, may coincide with those which are perceived by the other." With respect to visible distance, the author's opinion seems not to differ from that which we have stated elsewhere (see Metaphysics, N° 49, 50.); and therefore we have to attend only to what he says of visible direction.

* *Essay on Single Vision, &c.*

When a small object is so placed with respect to either eye, as to be seen more distinctly than in any other situation, our author says that it is then in the *optic axis*, or the axis of that eye. When the two optic axes are directed to a small object not very distant, they may be conceived to form two sides of a triangle, of which the base is the interval between the points of the corners where the axis enter the eyes. This base he called the *visual base;* and a line drawn from the middle of it to the point of intersection of the optic axis he calls the *common axis*. He then proceeds to show, that objects *really situated* in the *optic* axis do not *appear* to be in that line, but in the *common axis*.

Every person (he observes) knows, that if an object be viewed through two small holes, one applied to each eye, the two holes appear but as one. The theories hitherto invented afford two explanations of this fact. According to Aguilonius, Dechales, Dr Porterfield, and Dr Smith, the two holes, or rather their borders, will be seen in the same place as the object viewed through them, and will consequently appear united, for the same reason that the object itself is seen single. But whoever makes the experiment will distinctly perceive, that the united hole is much nearer to him than the object; not to mention, that any fallacy on this head might be corrected by the information from the sense of touch, that the card or other substance in which the holes have been made is within an inch or less of our face. The other explanation is that furnished by the theory of Dr Reid. According to it, the centres of the retinas, which in this experiment receive the pictures of the holes, will, by an original property, represent but one. This theory, however, though it makes the two holes to appear one, does not determine where this one is to be seen. It cannot be seen in only one of the perpendiculars to the images upon the retinas, for no reason can be given why this law, of visible direction, which Dr Reid thinks established beyond dispute, if it operates at all, should not operate upon both eyes at the same time; and if it be seen by both eyes in such lines, it must appear where those lines cross each other, that is, in the same place with the object viewed through the holes, which, as I have already mentioned, is contrary to experience. Nor is it seen in any direction, the consequence of a law affecting both eyes considered as one organ, but suspended when each eye is used separately. For when the two holes appear one, if we pay attention to its situation, and then close one eye, the truly single hole will be seen by the eye remaining open in exactly the same direction as the apparently single hole was by both eyes.

"Hitherto I have supposed the holes almost touching the face. But they have the same unity of appearance, in whatever parts of the optic axes they are placed; whether both be at the same distance from the eyes, or one be close to the eye in the axis of which it is, and the other almost contiguous to the object seen through them. If a line, therefore, be drawn from the object to one of the eyes, it will represent all the real or tangible positions of the hole, which allow the object to be seen by that eye, and the whole of it will coincide with the optic axis. Let a similar line be drawn to the other eye, and the two must appear but as one line; for if they do not, the two holes in the optic axes will not, at every distance, appear one, whereas experiments prove that they do. This united line will therefore represent the visible direction of every object situated in either of the optic axes. But the end of it, which is towards the face, is seen by the right eye to the left, and by the left eye as much to the right. It must be seen then in the middle between the two, and consequently in the common axis. And as its other extremity coincides with the point where the optic axes intersect each other, the whole of it must lie in the common axis. Hence the truth of the proposition is evident, that objects situated in the optic axis, do not appear to be in that line, but in the common axis."

He then proves by experiments, that objects situated in the common axis did not *appear* to be in that line, but in the axis of the eye by which they are not seen: that is, an object situated in the common axis appears to the right eye in the axis of the left, and *vice versa*. His next proposition, proved likewise by experiments, is, that "objects, situated in any line drawn through the mutual intersection of the optic axes to the visual base, do not appear to be in that line, but in another drawn through the same intersection, to a point in the visual base distant half this base from the similar extremity of the former line towards the left, if the objects be seen

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seen by the right eye, but towards the right if seen by the left eye."

From these propositions he thus accounts for single vision by both eyes. "If the question be concerning an object at the concourse of the optic axes, it is seen single, because its two similar appearances, in regard to size, shape, and colour, are seen by both eyes in one and the same direction, or if you will, in two directions, which coincide with each other through the whole of their extent. It therefore matters not whether the distance be truly or falsely estimated; whether the object be thought to touch our eyes, or to be infinitely remote. And hence we have a reason, which no other theory or visible direction affords, why objects appeared single to the young gentleman mentioned by Mr Cheselden, immediately after his being couched, and before he could have learned to judge of distance by sight.

"When two similar objects are placed in the optic axes, one in each, at equal distances from the eyes, they will appear in the same place, and therefore one, for the same reason that a truly single object, in the concourse of the optic axes, is seen single.

"To finish this part of my subject, it seems only necessary to determine, whether the dependence of visible direction upon the actions of the muscles of the eyes be established by nature, or by custom. But facts are here wanting. As far as they go, however, they serve to prove that it arises from an original principle of our constitution. For Mr Cheselden's patient saw objects single, and consequently in the same directions with both eyes, immediately after he was couched; and persons affected with squinting from their earliest infancy see objects in the same directions with the eye they have never been accustomed to employ, as they do with the other they have constantly used."

150
Objects seen with both eyes appear brighter than when seen with one.

We are indebted to Dr Jurin for the following curious experiments, to determine whether an object seen by both eyes appears brighter than when seen with one only.

He laid a slip of clean white paper directly before him on a table, and applying the side of a book close to his right temple, so that the book was advanced considerably farther forward than his face, he held it in such a manner, as to hide from his right eye that half of the paper which lay to his left hand, while the left half of the paper was seen by both eyes, without any impediment.

Then looking at the paper with both eyes, he observed it to be divided, from the top to the bottom, by a dark line, and the part which was seen with one eye only was manifestly darker than that which was seen with both eyes; and, applying the book to his left temple, he found, by the result of the experiment, that both his eyes were of equal goodness.

He then endeavoured to determine the excess of this brightness; and comparing it with the appearance of an object illuminated partly by one candle and partly by two, he was surprised to find that an object seen with two eyes is by no means twice as luminous as when it is seen with one; and after a number of trials, he found, that when one paper was illuminated by a candle placed at the distance of three feet, and another paper by the same candle at the same distance, and by another candle at the distance of 11 feet, the former seen by both eyes and the latter with one eye only, appeared to be of equal whiteness; so that an object seen with both eyes appears brighter than when it is seen with one only by about a 13th part.

He then proceeded to inquire, whether an object seen with both eyes appears larger than when seen with one; but he concluded that it did not, except on account of some particular circumstances, as in the case of the binocular telescope and the concave speculum.

M. du Tour maintains, that the mind attends to no more than the image made in one eye at a time, and produces several curious experiments in favour of this hypothesis, which had also been maintained by Kepler and almost all the first opticians. But, as M. Buffon observes, it is a sufficient answer to this hypothesis, however ingeniously it may be supported, that we see more distinctly with two eyes than with one; and that when a round object is near us, we see more of the surface in one case than in the other.

With respect to single vision with two eyes, Dr Hartley observes, that it deserves particular attention, that the optic nerves of men, and such other animals as look the same way with both eyes, unite in the *cella turcica* in a ganglion, or little brain, as one may call it, peculiar to themselves; and that the associations between synchronous impressions on the two retinas must be made sooner and cemented stronger on this account: also that they ought to have a much greater power over one another's images, than in any other part of the body. And thus an impression made on the right eye alone, by a single object, may propagate itself into the left, and there raise up an image almost equal in vividness to itself; and consequently when we see with one eye only, we may, however, have pictures in both eyes.

A curious deception in vision, arising from the use of both eyes, was observed and accounted for by Dr Smith. It is a common observation, he says, that objects seen with both eyes appear more vivid and stronger than they do to a single eye; especially when both of them are equally good. A person not short-sighted may soon be convinced of this fact, by looking attentively at objects that are pretty remote, first with one eye, and then with both. This observation gave occasion to the construction of the binocular telescope, in the use of which the phenomenon is still more striking.

Besides this, Dr Smith observes, that there is another phenomenon observable with this instrument, which is very remarkable. In the foci of the two telescopes there are two equal rings, as usual, which terminate the pictures of the objects there formed, and consequently the visible area of the objects themselves. These equal rings, by reason of the equal eye-glasses, appear equal and equidistant when seen separately by each eye; but when they are seen with both eyes, they appear much larger, and more distant also; and the objects seen through them also appear much larger, though circumscribed by their united rings, in the same places as when they were seen separately.

He observes that the phenomenon of the enlarged circle of the visible area in the binocular telescope, may be seen very plainly in looking at distant objects through a pair of spectacles, removed from the eyes about four or five inches, and held steady at that distance. The two innermost of the four apparent rings, which hold the glasses, will then appear united in one larger and more

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more distant ring than the two outermost, which will hardly be visible unless the spectacles be farther removed.

A curious circumstance relating to the effect of one eye upon the other, was noticed by M. Æpinus, who observed, that, when he was looking through a hole made in a plate of metal, about the 10th part of a line in diameter, with his left eye, both the hole itself appeared larger, and also the field of view seen through it was more extended, whenever he shut his right eye; and both these effects were more remarkable when that eye was covered with his hand. He found considerable difficulty in measuring this augmentation of the apparent diameter of the hole, and of the field of view; but at length he found, that, when the hole was half an inch, and the tablet which he viewed through it was three feet from his eye, if the diameter of the field when both his eyes were open was 1, it became $1\frac{1}{7}$ when the other eye was shut, and nearly 2 when his hand was laid upon it.

151 When one eye is closed, the pupil of the other is enlarged.

Upon examining this phenomenon, it presently appeared to depend upon the enlargement of the pupil of one eye when the other is closed, the physical cause of which he did not pretend to assign; but he observes, that it is wisely appointed by Providence, in order that when one eye fails, the field of view in the other may be extended. That this effect should be more sensible when the eye is covered with the hand, is owing, he observes, to the eye-lids not being impervious to the light. But the augmentation of the pupil does not enlarge the field of view, except in looking through a hole, as in this particular case; and therefore persons who are blind of one eye can derive no advantage from this circumstance.

A great deal has been written by Gassendi, Le Clerc, Musschenbroek, and Du Tour, concerning the place to which we refer an object viewed by one or both eyes. But the most satisfactory account of this matter that we have met with, will be found in Dr Wells's Essay above quoted.

Sect. VI. *Of the Appearance of Objects seen through Media of different Forms.*

152 The various appearances of objects seen thro' media of different forms stated and investigated.

For the more easy apprehension of what relates to this subject, we shall premise the five following particulars, which either have been already mentioned, or follow from what has been before laid down.

1. That as each point of an object, when viewed by the naked eye, appears in its proper place, and as that place is always to be found in the line in which the axis of a pencil of rays flowing from it enters the eye, or else in the line which Dr Wells calls the common axis; we hence acquire a habit of considering the point to be situated in that line: and, because the mind is unacquainted with what refractions the rays suffer before they enter the eye, therefore, in cases where they are diverted from their natural course, by passing through any medium, it judges the point to be in that line produced back in which the axis of a pencil of rays flowing from it is situated the instant they enter the eye, and not in that it was in before refraction. We shall, therefore, in what follows, suppose the apparent place of an object, when seen through a refracting medium, to be somewhere in that line produced back in which the axis of a pencil of rays flowing from it proceeds after they have passed through the medium.

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2. That we are able to judge, though imperfectly, of the distance of an object by the degree of divergency, wherein the rays flowing from the same point of the object enter the pupil of the eye, in cases where that divergency is considerable; but because in what follows it will be necessary to suppose an object, when seen through a medium whereby its apparent distance is altered, to appear in some determinate situation, in those cases where the divergency of the rays at their entrance into the eye is considerable, we will suppose the object to appear where those lines which they describe in entering, if produced back, would cross each other: though it must not be asserted, that this is the precise distance; because the brightness, distinctness, and apparent magnitude of the object, on which its apparent distance in some measure depends, will also suffer an alteration by the refraction of the rays in passing through that medium.

3. That we estimate the magnitude of an object by that of the optic angle.

4. That vision is the brighter, the greater the number of rays is which enter the pupil.

5. And that, in some cases, the apparent brightness, distinctness, and magnitude of an object, are the only means by which our judgment is determined in estimating the distance of it.

Prop. I.

An object placed within a medium terminated by a plane surface on that side which is next the eye, if the medium be denser than that in which the eye is (as we shall suppose it to be, unless where the contrary is expressed), appears nearer to the surface of the medium than it is.

Thus, if A (fig. 5.) be a point of an object placed within the medium BCDE, and A b A c be two rays proceeding from thence, these rays passing out of a denser into a rarer medium, will be refracted from their respective perpendiculars $b\,d$, $c\,e$, and will enter the eye at H, suppose in the direction $b\,f$, $c\,g$: let then these lines be produced back till they meet in F; this will be the apparent place of the point A; and because the refracted rays $b\,f$, $c\,g$ will diverge more than the incident ones A b, A c, it will be nearer to the points b and c than the point A; and as the same is true of each point in the object, the whole will appear, to an eye at H, nearer to the surface BC than it is. Plate ccclxxxi. fig. 5.

Hence it is, that when one end of a straight stick is put under water, and the stick is held in an oblique position, it appears bent at the surface of the water; viz. because each point that is under water appears nearer the surface, and consequently higher than it is.

From this likewise it happens, that an object at the bottom of a vessel may be seen when the vessel is filled with water, though it be so placed with respect to the eye, that it cannot be seen when the vessel is empty. To explain this, let ABCD (fig. 6.) represent a vessel, and Fig 6. let E be an object lying at the bottom of it. This object, when the vessel is empty, will not be seen by an eye

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eye at F, because HB, the upper part of the vessel, will obstruct the ray EH; but when it is filled with water to the height GH, the ray at EK being refracted at the surface of the water into the line KF, the eye at F shall see the object by means of that.

153
An object situated in the horizon appears above its true place.

In like manner, an object situated in the horizon appears above its true place, on account of the refraction of the rays which proceed from it in their passage through the atmosphere. For, first, If the object be situated beyond the limits of the atmosphere, its rays in entering it will be refracted towards the perpendicular; that is, towards a line drawn from the point where they enter, to the centre of the earth, which is the centre of the atmosphere: and as they pass on, they will be continually refracted the same way, because they are all along entering a denser part, the centre of whose convexity is still the same point; upon which account the line they describe will be a curve bending downwards: and therefore none of the rays that come from that object can enter an eye upon the surface of the earth, except what enter the atmosphere higher than they need to do if they could come in a right line from the object: consequently the object must appear above its proper place. Secondly, If the object be placed within the atmosphere, the case is still the same; for the rays which flow from it must continually enter a denser medium whose centre is below the eye; and therefore being refracted towards the centre, that is, downwards as before, those which enter the eye must necessarily proceed as from some point above the object; whence the object will appear above its proper place.

Hence it is, that the sun, moon, and stars, appear above the horizon, when they are just below it; and higher than they ought to do, when they are above it: Likewise distant hills, trees, &c. seem to be higher than they are.

Besides, The lower these objects are in the horizon, the greater is the obliquity with which the rays which flow from them enter the atmosphere, or pass from the rarer into the denser parts of it; and therefore they appear to be the more elevated by refraction: on which account the lower parts of them are apparently more elevated than the rest. This makes their upper and under parts seem nearer than they are; as is evident from the sun and moon, which appear of an oval form when they are in the horizon, their horizontal diameters appearing of the same length that they would do if the rays suffered no refraction, while their vertical ones are thus shortened.

Prop. II.

An object seen through a medium terminated by plane and parallel surfaces, appears nearer, brighter, and larger, than with the naked eye.

154
An object seen thro' a plane medium appears nearer and brighter than seen by the naked eye;
Plate CCCLXXXI. fig. 7.

For instance, let AB (fig. 7.) be the object, CDEF the medium, and GH the pupil of an eye, which is here drawn large to prevent confusion in the figure.—And, 1. Let RK, RL, be two rays proceeding from the point R, and entering the denser medium at K and L; these rays will here by refraction be made to diverge less, and to proceed afterwards, suppose in the lines K *a*, L *b*; at *a* and *b*, where they pass out of the denser medium, they will be as much refracted the contrary way, proceeding in the lines *a c*, *b d*, parallel to their first directions. Produce these lines back till they meet in *e*: this will be the apparent place of the point R; and it is evident from the figure, that it must be nearer the eye than that point; and because the same is true of all other pencils flowing from the object A B, the whole will be seen in the situation *f g*, nearer to the eye than the line AB. 2. As the rays RK, RL would not have entered the eye, but have passed by it in the directions K *r*, L *t*, had they not been refracted in passing through the medium, the object appears brighter. 3. The rays A *h*, B *i*, will be refracted at *h* and *i* into the less converging lines *h k*, *i l*, and at the other surface into *k* M, *l* M, parallel to A *h* and B *i* produced; so that the extremities of the object will appear in the lines M *k*, M *l* produced, viz. in *f* and *g*, and under as large an angle *f* M *g*, as the angle A *q* B under which an eye at *q* would have seen it had there been no medium interposed to refract the rays: and therefore it appears larger to the eye GH, being seen through the interposed medium, than otherwise it would have done. But it is here to be observed, that the nearer the point *e* appears to the eye on account of the refraction of the rays RK, RL, the shorter is the image *f g*, because it is terminated by the lines M *f* and M *g*, upon which account the object is made to appear less; and therefore the apparent magnitude of an object is not much augmented by being seen through a medium of this form.

Farther, it is apparent from the figure, that the effect of a medium of this form depends wholly upon its thickness; for the distance between the lines R *r* and *e c*, and consequently the distance between the points *e* and R, depends upon the length of the line K *a*:—Again, The distance between the lines AM and *f* M depends on the length of the line *h k*; but both K *a* and *k h* depend on the distance between the surfaces CE and DF, and therefore the effect of this medium depends upon its thickness.

Prop. III.

An object seen through a convex lens, appears larger, brighter, and more distant, than with the naked eye.

155
Seen thro' a convex lens, appears larger, brighter, and more distant.
Fig. 8.

To illustrate this, let AB (fig. 8.) be the object, CD the lens, and EF the eye. 1. From A and B, the extremities of the object, draw the lines AY *r*, BX *r*, crossing each other in the pupil of the eye; the angle A *r* B comprehended between these lines, is the angle under which the object would be seen with the naked eye. But by the interposition of a lens of this form, whose property it is to render converging rays more so, the rays AY and BX will be made to cross each other before they reach the pupil. There the eye at E will not perceive the extremities of the object by means of these rays (for they will pass it without entering), but by some others which must fall without the points Y and X, or between them; but if they fall between them, they will be made to concur sooner than they themselves would have done: and therefore, if the extremities of the object could not be seen by them, it will much less be seen by these. It remains therefore, that the rays which will enter the eye from the points A and B after refraction, must fall upon the lens without the points Y and X;

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X; let then the rays AO and BP be such. These after refraction entering the eye at r, the extremities of the object will be seen in the lines r Q, r T, produced, and under the optic angle Q r T, which is larger than A r B, and therefore the apparent magnitude of the object will be increased.—2. Let GHI be a pencil of rays flowing from the point G; as it is the property of this lens to render diverging rays less diverging, parallel, or converging, it is evident that some of those rays, which would proceed on to F and E, and miss the eye were they to suffer no refraction in passing through the lens, will now enter it; by which means the object will appear brighter. 3. The apparent distance of the object will vary according to the situation of it with respect to the focus of parallel rays of the lens. 1. Then, let us suppose the object placed so much nearer the lens than its focus of parallel rays, that the refracted rays KE and LF, though rendered less diverging by passing through it, may yet have a considerable degree of divergency, so that we may be able to form a judgment of the distance of the object thereby. In this case, the object ought to appear where EK, FL produced back concur; which, because they diverge less than the rays GH, GI, will be beyond G, that is, at a greater distance from the lens than the object is. But because both the brightness and magnitude of the object will at the same time be augmented, prejudice will not permit us to reckon it quite so far off as the point where those lines meet, but somewhere between that point and its proper place. 2. Let the object be placed in the focus of parallel rays, then will the rays KE and LF become parallel; and though in this case the object would appear at an immense distance, if that distance were to be judged of by the direction of the rays KE and LF, yet on account of its brightness and magnitude we shall not think it much farther from us than if it were seen by the naked eye. 3. If the object be situated beyond the focus of parallel rays, as in BA, the rays flowing from it, and falling upon the lens CD, will be collected into their respective foci at a and b, and the intermediate points m, n, &c. and there will form an image of the object AB; and after crossing each other in the several points of it, as expressed in the figure, will pass on diverging as from a real object. Now if an eye be situated at c, where A c, B c, rays proceeding from the extreme points of the object, make not a much larger angle A c B, than they would do if no lens were interposed, and the rays belonging to the same pencil do not converge so much as those which the eye would receive if it were placed nearer to a or b, the object upon these accounts appearing very little larger or brighter than with the naked eye, is seen nearly in its proper place: but if the eye recede a little way towards $a\,b$, the object then appearing both brighter and larger seems to approach the lens: which is an evident proof of what has been so often asserted, viz. that we judge of the distance of an object in some measure by its brightness and magnitude; for the rays converge the more the farther the eye recedes from the lens; and therefore if we judged of the distance of the object by the direction of the rays which flow from it, we ought in this case to conceive it at a greater distance, than when the rays were parallel, or diverged at their entrance into the eye.

Plate CCCLXXXI. fig. 9.

That the object should seem to approach the lens in this case, was a difficulty that puzzled Dr Barrow, and which he pronounces insuperable, and not to be accounted for by any theory we have of vision. Molineux also leaves it to the solution of others, as that which will be inexplicable, till a more intimate knowledge of the visive faculty, as he expresses it, be obtained by mortals.

They imagined, that since an object appears farther off, the less the rays diverge which fall upon the eye, if they should proceed parallel to each other, it ought to appear exceeding remote; and if they should converge, it should then appear more distant still: the reason of this was, because they looked upon the apparent place of an object, as owing only to the direction of the rays whatever it was, and not at all to its apparent magnitude or splendour.

Perhaps it may proceed from our judging of the distance of an object in some measure by its magnitude, that the deception of sight commonly observed by travellers may arise; viz. that upon the first appearance of a building larger than usual, as a cathedral church, or the like, it generally seems nearer to them, than they afterwards find it to be.

Prop. IV.

If an object be placed farther from a convex lens than its focus of parallel rays, and the eye be situated farther from it on the other side than the place where the rays of the several pencils are collected into their proper foci, the object appears inverted, and pendulous in the air, between the eye and the lens.

156 In certain circumstances an object seen through a convex lens appears inverted and pendulous in the air. Fig. 9.

To explain this, let AB represent the object, CD the lens; and let the rays on the pencil ACD be collected in a, and those of BCD in b, forming there an inverted image of the object AB, and let the eye be placed in F: it is apparent from the figure, that some of the refracted rays which pass through each point of the image will enter the eye as from a real object in that place; and therefore the object AB will appear there, as the proposition asserts. But we are so little accustomed to see objects in this manner, that it is very difficult to perceive the image with one eye; but if both eyes are situated in such a manner, that rays flowing from each point of the image may enter both, as at G and H, and we direct our optic axes to the image, it is easy to be perceived.

If the eye be situated in a or b, or very near them on either side, the object appears exceedingly indistinct, viz. if at d, the rays which proceed from the same point of the object converge so very much, and if at e, they diverge so much, that they cannot be collected together upon the retina, but fall upon it as if they were the axes of so many distinct pencils coming through every point of the lens; wherefore little more than one single point of the object is seen at a time, and that appears all over the lens; whence nothing but indistinctness arises.

If the lens be so large that both eyes may be applied to it, as in h and k, the object will appear double; for it is evident from the figure, that the rays which enter the eye at h from either extremity of the object A or B, do not proceed as from the same point with that

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that from whence those which enter the other at k seem to flow; the mind therefore is here deceived, and looks upon the object as situated in two different places, and therefore judges it to be double.

Prop. V.

157
An object through a concave lens is seen nearer, smaller, and less bright than with the naked eye. Fig. 10.

An object seen through a concave lens appears nearer, smaller, and less bright, than with the naked eye.

Thus, let AB (fig. 10.) be the object, CD the pupil of an eye, and EF the lens. Now, as it is the property of a lens of this form to render diverging rays more so, and converging ones less so, the diverging rays GH, GI, proceeding from the point G, will be made to diverge more, and so to enter the eye as from some nearer point g; and the rays AH, BI, which converge, will be made to converge less, and to enter the eye as from the points a and b; wherefore the objects will appear in the situation $a\,g\,h$, less and nearer than without the lens. Further, As the rays which proceed from G are rendered more diverging, some of them will pass by the pupil of the eye, which otherwise would have entered it, and therefore each point of the object will appear less bright.

Prop. VI.

An object seen through a polygonal glass, that is, one which is terminated by several plain surfaces, is multiplied thereby.

Plate CCCLXXXI. fig. 11.

Let A be an object, and BC a polygonous glass terminated by the plane surfaces BD, DE, &c. and let the situation of the eye F be such, that the rays AB being refracted in passing through the glass, may enter it in the direction BF, and the rays AC in the direction CF. Then will the eye, by means of the former, see the object in G, and by the latter in H; and by means of the rays AI, the object will also appear in its proper situation A.

Sect. VII. *On the Reflection of Light.*

158
Some portion of light always reflected from transparent bodies.

When a ray of light falls upon any body, however transparent, the whole of it never passes through the body, but some part is always reflected from it; and it is by this reflected light that all bodies which have no light of their own become visible to us. Of that part of the ray which enters, another part is also reflected from the second surface, or that which is farthest from the luminous body. When this part arrives again at the first surface, part of it is reflected back from that surface; and thus it continues to be reflected between the two surfaces, and to pass backwards and forwards within the substance of the medium, till some part is totally extinguished and lost. Besides this inconsiderable quantity, however, which is lost in this manner, the second surface often reflects much more than the first; so that, in certain positions, scarcely any rays will pass through both sides of the medium. A very considerable quantity is also unaccountably lost at each reflecting surface; so that no body, however transparent, can transmit all the rays which fall upon it; neither, though it be ever so well fitted for reflection, will it reflect them all.

On the Cause of Reflection.

Cause of Reflection.

The reflection of light is not so easily accounted for as refraction. This last property may be accounted for in a satisfactory manner, by the supposition of a attractive power diffused throughout the medium, and extending a very little way beyond it; but with regard to the reflection of light, there seems to be no satisfactory hypothesis hitherto invented. Of the principal opinions on this subject Mr Rowning has given us the following account.

159
Light is not reflected by impinging on the solid parts of bodies at the first surface,

I. It was the opinion of philosophers, before Sir Isaac Newton discovered the contrary, that light is reflected by impinging upon the solid parts of bodies. But that this is not the case is evident from the following reasons.

First, It is not reflected at the first surface of a body by impinging against it. For in order that the light may be regularly reflected, there should be no asperities or unevenness in the reflecting surface large enough to bear a sensible proportion to the magnitude of a ray of light; because if the surface abound with these, the incident rays would be irregularly scattered rather than reflected with that regularity with which light is observed to be from a well polished surface. Now those surfaces, which to our senses appear perfectly smooth and well polished, are far from being so; for to polish, is only to grind off the larger protuberances of the metal with the rough and sharp particles of emery, which must of necessity leave behind them an infinity of asperities and scratches, which, though inconsiderable with regard to the former roughnesses, and too minute to be discerned by us, must nevertheless bear a large proportion to, if not vastly exceed, the magnitude of the particles of light. 160

nor at the second.

Secondly, It is not reflected at the second surface by impinging against any solid particles. That it is not reflected by impinging upon the solid particles which constitute this second surface, is sufficiently obvious from the foregoing argument; the second surfaces of bodies being as incapable of a perfect polish as the first: and it is farther confirmed from this, viz. that the quantity of light reflected differs according to the different density of the medium behind the body. It is likewise not reflected by impinging upon the particles which constitute the surface of the medium behind it, because the strongest reflection at the second surface of a body, is when there is a vacuum behind it. 161

Supposition of a repulsive force;

II. It has been the opinion of some, that light is reflected at the first surface of a body, by a repulsive force equally diffused over it: and at the second, by an attractive force. 162

objected to.

1. If there be a repulsive force diffused over the surface of bodies that repels the rays of light, then, since by increasing the obliquity of a ray we diminish its perpendicular force (which is that only whereby it must make its way through this repulsive force), however weakly that force may be supposed to act, rays of light may be made to fall with so great a degree of obliquity on the reflecting surface, that there shall be a total reflection of them there, and not one particle of light be able to make its way through: which is contrary to observation; the reflection of light at the first surface of a transparent body being never total in any obliquity whatever. 163

Attractive force supposed;

2. As to the reflection at the second surface by the attractive

Cause of Reflection.

attractive force of the body; this may be considered in two respects: first, when the reflection is total; secondly, when it is partial.

First, In cases where the reflection is total, the cause of it is undoubtedly that same attractive force by which light would be refracted in passing out of the same body. This is manifest from that analogy which is observable between the reflection of light at the second surface, and its refraction there. For, otherwise, what can be the reason that the total reflection should begin just when the obliquity of the incident ray, at its arrival at the second surface, is such, that the refracted angle ought to be a right one; or when the ray, were it not to return in reflection, ought to pass on parallel to the surface, without going from it? For in this case it is evident, that it ought to be returned by this very power, and in such a manner that the angle of reflection shall be equal to the angle of incidence; just as a stone thrown obliquely from the earth, after it is so far turned out of its course by the attraction of the earth, as to begin to move horizontally, or parallel to the surface of the earth, is then by the same power made to return in a curve similar to that which is described in its departure from the earth, and so falls with the same degree of obliquity that it was thrown with.

164 Objection.

But, secondly, As to the reflection at the second surface, when it is partial; an attractive force uniformly spread over it, as the abettors of this hypothesis conceive it to be, can never be the cause thereof. Because it is inconceivable, that the same force, acting in the same circumstances in every respect, can sometimes reflect the violet-coloured rays, and transmit the red, and at other times reflect the red and transmit the violet.

This objection, however, is not well founded; for in each colour, the reflection takes place at that angle, and no other, where the refraction of *that* ray would make it parallel to the posterior surface.

This partial reflection and refraction is a great difficulty in all the attempts which have been made to give a mechanical explanation of the phenomena of optics. It is equally a desideratum in that explanation which was proposed by Huygens, by means of the undulations of an elastic fluid, although a vague consideration of undulatory motions seems to offer a very specious analogy. But a *rigid* application of the *knowledge* we have acquired of these motions, will convince us that the phenomena of undulation are essentially dissimilar to the phenomena of light. The inflection and refraction of light, demonstrate that light *is acted on* by moving forces in a direction perpendicular to the surface; and it is equally demonstrable that such forces must, in proper circumstances, produce reflections precisely such as we observe. The only difficulty is to show how there can be forces which produce both reflection and refraction, in circumstances which are similar. The fact is, that such effects are produced: the first logical inference is, that with respect to the light which is reflected and that which is refracted, the circumstances are *not* similar; and our attention should be directed to the discovery of that dissimilarity. All the phenomena of combined reflection and refraction should be examined and classed according to their generality, not doubting but that these points of resemblance will lead to the discovery of their causes. Now the experiments of M. Bouguer show that bodies differ in their powers of thus separating light by reflection and refraction. It is not therefore *a general property of light* to be partly reflected and partly refracted, but a *distinctive* property of *different* bodies; and since we see that they possess it in different degrees, we are authorized to conclude that some bodies may want it altogether. We may therefore expect some success, by considering how bodies are affected by light, as well as how light is affected by bodies. Now, in all the phenomena of the material world we find bodies connected by mutual forces. We know no case where a body A tends towards a body B, or, in common language, is attracted by it, without, at the same time, the body B tending towards A. This is observed in the phenomena of magnetism, electricity, gravitation, corpuscular attraction, impulse, &c. We should therefore conclude from analogy, that as bodies change the motion of light, light also changes the motion of bodies; and that the particles near the surface are put into vibration by the passage of light through among them.

165 The objection obviated.

Suppose a parcel of cork balls all hanging as pendulums in a symmetrical order, and that an electrified ball passes through the midst of them; it is very easy to show that it may proceed through this assemblage in various directions with a sinuated motion, and without touching any of them, and that its ultimate direction will have a certain inclination to its primary direction, depending on the outline of the assemblage, just as is observed in the motion of light; and, in the mean time, the cork balls will be variously agitated. Just so must it happen to the particles of a transparent body, if we suppose that they act on the particles of light by mutual attractions and repulsions.

An attentive consideration of what happens here will show us that the superficial particles will be much more agitated than the rest; and thus a stratum be produced, which, in any instant, will act on those particles of light which are then approaching them in a manner different from that in which they will act on similarly situated particles of light, which come into the place of the first in the following moment, when these acting particles of the body have (by their motion of vibration) changed their own situation. Now it is clearly understood, that, in all motions of vibration, such as the motions of pendulums, there is a moment when the body is in its natural situation, as when the pendulum is in the vertical line. This may happen in the same instant in each atom of the transparent body. The particles of light which then come within the sphere of action may be wholly reflected; in the next moment, particles of light in the very situation of the first may be refracted,

Then will arise a separation of light; and as this will depend on the manner in which the particles of bodies are agitated by it during its passage, and as this again will depend on the nature of the body, that is, on the law of action of those forces which connect the particles with each other, and with the particles of light, it will be different in different bodies. But in all bodies there will be this general resemblance, that the separation will be most copious in great obliquities of incidence, which gives the repulsive forces more time for action, while it diminishes the perpendicular force of the light. Such a resemblance between the phenomena and the

Cause of Reflection.

the legitimate consequences of the assumption (the agitation of the parts of the body), gives us some authority for assigning this as the cause; nor can the assumption be called *gratuitous*. To suppose that the particles of the transparent body *are not thus agitated*, would be a most gratuitous contradiction of a law of nature to which we know no other exception.

Thus the objection stated in N° 164. is obviated, because the reflection and refraction are not here conceived as simultaneous, but as successive.

166 Another hypothesis.

III. Some have supposed, that, by the action of light upon the surface of bodies, their parts are put into an undulatory motion; and that where the surface of it is subsiding light is transmitted, and in those places where it is rising light is reflected.

But to overlook the objections which we have just made to this theory of undulation, we have only to observe, that, were it admitted, it does not seem to advance us a step farther; for in those cases, suppose where red is reflected and violet transmitted, how comes it to pass that the red impinges only on those parts when the waves are rising, and the violet when they are subsiding?

167 Sir I. Newton's hypothesis;

IV. The next hypothesis is that remarkable one of Sir Isaac Newton's fits of easy reflection and transmission, which we shall now explain and examine.

That author, as far as we can apprehend his meaning in this particular, is of opinion, that light in its passage from the luminous body, is disposed to be alternately reflected by, and transmitted through, any refracting surface it may meet with; that these dispositions, which he calls *fits of easy reflection and easy transmission*, return successively at equal intervals; and that they are communicated to it at its first emission out of the luminous body, from which it proceeds probably by some very subtle and elastic substance diffused through the universe, and that in the following manner. As bodies falling into water, or passing through the air, produce undulations in each, so the rays of light may excite vibrations in this elastic substance. The quickness of these vibrations depending on the elasticity of the medium (as the quickness of the vibrations in the air, which propagate sound, depend solely on the elasticity of the air, and not upon the quickness of those in the sounding body), the motion of the particles of it may be quicker than that of the rays, and therefore, when a ray at the instant it impinges upon any surface, is in that part of a vibration of this elastic substance which conspires with its motion, it may be easily transmitted; and when it is in that part of a vibration which is contrary to its motion, it may be reflected. He further supposes, that when light falls upon the surface of a body, if it be not in a fit of easy transmission, every ray is there put into one, so that when they come at the other side (for this elastic substance, pervading the pores of bodies, is capable of the same vibrations within the body as without it), the rays of one colour shall be in a fit of easy transmission, and those of another in a fit of easy reflection, according to the thickness of the body, the intervals of the fits being different in rays of a different kind. This seems to account for the different colours of the bubble and thin plate of air and water; and likewise for the reflection of light at the second surface of a thicker body; for the light thence reflected is also observed to be coloured, and to form rings according to the different thickness of the body, when not intermixed and confounded with other light, as will appear from the following experiment. If a piece of glass be ground concave on one side and convex on the other, both its concavity and convexity having one common centre; and if a ray of light be made to pass through a small hole in a piece of paper held in that common centre; and be permitted to fall on the glass; besides those rays which are regularly reflected back to the hole again, there will be others reflected to the paper, and form coloured rings surrounding the hole, not unlike those occasioned by the reflection of light from thin plates.

168 This hypothesis untenable.

It is ever with extreme reluctance that we venture to call in question the doctrines of Newton; but to his theory of reflection there is this insuperable objection, that it explains nothing, unless the *cause* of the fits of more easy reflection and transmission be held as legitimate, namely, that *they are produced by the undulations of another elastic fluid, incomparably more subtile than light*, acting upon it in the way of impulse. The fits themselves are *matters of fact*, and no way different from what we have endeavoured to account for; but to admit this theory of them would be to transgress every rule of philosophizing.

Of the Laws of Reflection.

169 The fundamental law of reflection.

The fundamental law of the reflection of light, is, that the angle of reflection is always equal to the angle of incidence. This is found by experiment to be the case, and besides may be demonstrated mathematically from the laws of impulse in bodies perfectly elastic. The axiom therefore holds good in every case of reflection, whether it be from plane or spherical surfaces; and hence the seven following propositions relating to the reflection of light from plane and spherical surfaces may be deduced.

I. *Rays of light reflected from a plane surface have the same degree of inclination to one another that their respective incident ones have.*—For the angle of reflection of each ray being equal to that of its respective incident one, it is evident, that each reflected ray will have the same degree of inclination to that portion of the surface from which it is reflected that its incident one has; but it is here supposed, that all those portions of surface from which the rays are reflected, are situated in the same plane; consequently the reflected rays will have the same degree of inclination to each other that their incident ones have, from whatever part of the surface they are reflected.

170 Laws of reflection from a concave surface. Plate cclxxxii. fig. 1.

II. *Parallel rays reflected from a concave surface are rendered converging.*—To illustrate this, let AF, CD, EB, (fig. 1.) represent three parallel rays falling upon the concave surface FB, whose centre is C. To the points F and B draw the lines CF, CB; these being drawn from the centre, will be perpendicular to the surface at those points. The incident ray CD also passing through the centre, will be perpendicular to the surface, and therefore will return after reflection in the same line; but the oblique rays AF and EB will be reflected into the lines FM and BM, situated on the contrary side of their respective perpendiculars CF and CB. They will therefore proceed converging after reflection towards some point, as M, in the line CD.

III. *Converging rays falling on a concave surface, are made*

Laws of Reflection *made to converge more.*—For, every thing remaining as above, let GF, HB, be the incident rays. Now, because these rays have greater angles of incidence than the parallel ones AF and EB in the foregoing case, their angles of reflection will also be larger than those of the others; they will therefore converge after reflection, suppose in the lines FN and BN, having their point of concourse N farther from the point C than M, that to which the parallel rays AF and EB converged to in the foregoing case; and their precise degree of convergency will be greater than that wherein they converged before reflection.

IV. *Diverging rays falling upon a concave surface, are, after reflection, parallel, diverging, or converging.* If they diverge from the focus of parallel rays, they then become parallel; if from a point nearer to the surface than that, they will diverge, but in a less degree than before reflection; if from a point between that and the centre, they will converge after reflection, to some point on the contrary side of the centre, but situated farther from it than the radiant point. If the incident rays diverge from a point beyond the centre, the reflected ones will converge to one on the other side of it, but nearer to it than the radiant point; and if they diverge from the centre, they will be reflected thither again.

1. Let them diverge in the lines MF, MB, proceeding from the radiant point M, the focus of parallel rays; then, as the parallel rays AF and EB were reflected into the lines FM and BM (by Prop. ii.), these rays will now on the contrary be reflected into them.

2. Let them diverge from N, a point nearer to the surface than the focus of parallel rays, they will then be reflected into the diverging lines FG and BH, which the incident rays GF and HB described that were shown to be reflected into them in the foregoing proposition; but the degree of their divergency will be less than their divergency before reflection.

3. Let them diverge from X, a point between the focus of parallel rays and the centre; they then make less angles of incidence than the rays MF and MB, which became parallel by reflection: they will consequently have less angles of reflection, and therefore proceed converging towards some point, as Y; which point will always fall on the contrary side of the centre, because a reflected ray always falls on the contrary side of the perpendicular with respect to that on which its incident one falls; and of consequence it will be farther distant from the centre than X.

4. If the incident rays diverge from Y, they will, after reflection, converge to X; those which were the incident rays in the former case being the reflected ones in this.

5. If the incident rays proceed from the centre, they fall in with their respective perpendiculars; and for that reason are reflected thither again.

171 From a convex surface. Plate CCCLXXXII. fig. 2.

V. *Parallel rays reflected from convex surfaces are rendered diverging.*—For, let AB, GD, EF, be three parallel rays falling upon the convex surface BF, whose centre is C, and let one of them, viz. GD, be perpendicular to the surface. Through B, D, and F, the points of reflection, draw the lines CV, CG, and CT; which, will be perpendicular to the surface at these points. The incident ray GD being perpendicular to the surface, will return after reflection in the same line, but the oblique ones AB and EF will return in the lines BK and FL, situated on the contrary side of their respective perpendiculars BV and FT. They will therefore diverge, after reflection, as from some point M in the line GD produced; and this point will be in the middle between D and C.

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VI. *Diverging rays reflected from convex surfaces are rendered more diverging.*—For, things remaining as above, let GB, GF, be the incident rays. These having greater angles of incidence than the parallel ones AB and EF in the preceding case, their angles of reflection will also be greater; they will therefore diverge after reflection, suppose in the lines BP and FQ, as from some point N, farther from C than the point M; and the degree of their divergency will exceed their divergency before reflection.

VII. *Converging rays reflected from convex surfaces are parallel, converging, or diverging.*—If they tend towards the focus of parallel rays, they then become parallel; if to a point nearer the surface, they converge, but in a less degree than before reflection; if to a point between that and the centre, they will diverge after reflection, as from some point on the contrary side of the centre, but situated farther from it than the point to which they converged; if the incident rays converge to a point beyond the centre, the reflected ones will diverge as from one on the contrary side of it, but nearer to it than the point to which the incident ones converged; and if the incident rays converge towards the centre, the reflected ones will seem to proceed from it.

1. Let them converge in the lines KB and LF, tending towards M, the focus of parallel rays; then, as the parallel rays AB, EF were reflected into the lines BK and FL by (Prop. v.) those rays will now on the contrary be reflected into them.

2. Let them converge in the lines PB, QF, tending towards N a point nearer the surface than the focus of parallel rays, they will then be reflected into the converging lines BG and FG, in which the rays GB, GF proceeded that were shown to be reflected into them by the last proposition: but the degree of their convergency will exceed their convergency before reflection.

3. Let them converge in the lines RB and SF proceeding towards X, a point between the focus of parallel rays and the centre; their angles of incidence will then be less than those of the rays KB and LF, which became parallel after reflection: their angles of reflection will therefore be less; on which account they must necessarily diverge, suppose in the lines BH and FI, from some point, as Y; which point (by Prop. iv.) will fall on the contrary side of the centre with respect to X, and will be farther from it than that.

4. If the incident rays tend towards Y, the reflected ones will diverge as from X; those which were the incident ones in one case being the reflected ones in the other.

5. If the incident rays converge towards the centre, they coincide with their respective perpendiculars; and will therefore proceed after reflection as from that centre.

We have already observed, that in some cases there is a very great reflection from the second surface of a transparent body. The degree of inclination necessary to cause a total reflection of a ray at this surface, is that which requires that the refracted angle (supposing the ray to pass out there) should be equal to or greater than a a right one; and consequently it depends on the refractive power of the medium through which the ray passes, and is therefore different in different media. When a ray passes through glass surrounded with air, and is inclined to its second surface under an angle of 42° or more, it will be wholly reflected there. For, as 11 is to 17 (the ratio of refraction out of glass into air), so is the sine of an angle of 42° to a fourth number that will exceed the sine of a right angle. Hence it follows, that when a ray of light arrives at the second surface of a transparent substance with as great or a greater degree of obliquity than that which is necessary to make a total reflection, it will there be all returned back to the first: and if it proceeds towards that with as great an obliquity as it did towards the other (which it will do if the surfaces of the medium be parallel to each other), it will there be all reflected again, &c. and will therefore never get out, but pass from side to side, till it be wholly extinguished within the body.—From this may arise an obvious inquiry, how it comes to pass, that light falling very obliquely upon a glass window from without, should be transmitted into the room. In answer to this it must be considered, that however obliquely a ray falls upon the surface of any medium whose sides are parallel as those of the glass in a window, it will suffer such a degree of refraction in entering there, that it shall fall upon the second with a less obliquity than that which is necessary to cause a total reflection. For since the medium be glass: then, as 17 is to 11, so is the sine of the greatest angle of incidence with which a ray can fall upon any surface to the sine of a less angle than that of total reflection. Therefore, if the sides of the glass be parallel, the obliquity with which a ray falls upon the first surface cannot be so great, that it shall pass the second without suffering a total reflection there.

When light passes out of a denser into a rarer medium, the nearer the second medium approaches the first in its refractive power, the less of it will be refracted in passing from one to the other; and when their refracting powers are equal, all of it will pass into the second medium.

The above propositions may be all mathematically demonstrated in the following manner:

Prop. I.

Of the reflection of rays from a plane surface.

172 The preceding propositions demonstrated mathematically.

When rays fall upon a plane surface, if they diverge, the focus of the reflected rays will be at the same distance behind the surface, that the radiant point is before it: if they converge, it will be at the same distance before the surface that the imaginary focus of the incident rays is behind it.

This proposition admits of two cases.

Case 1. *Of diverging rays.*

Plate CCCLXXXII. fig. 3.

Let AB, AC be two diverging rays incident on the plane surface DE, the one perpendicularly, the other obliquely: the perpendicular one AB will be reflected to A, proceeding as from some point in the line AB produced; the oblique one AC will be reflected into some line as CF, so that the point G, where the line FG produced intersects the line AB produced also, shall be at an equal distance from the surface DE with the radiant point A. For the perpendicular CH being drawn, ACH and HCF will be the angles of incidence and reflection; which being equal, their complements ACB and FCE are also equal: but the angle BCG is equal to its vertical angle FCE: therefore in the triangles ABC and GBC the angles at C are equal, the side BC is common, and the right angles at B are equal; therefore AB=BG: and consequently the point G, the focus of the incident rays AB, AC, is at the same distance behind the surface, that the point A is before it.

Case 2. *Of converging rays.*

This is the converse of the former case. For supposing FC and AB to be two converging incident rays, CA and BA will be the reflected ones (the angles of incidence in the former case being now the angles of reflection, and *vice versa*), having the point A for their focus; but this is at an equal distance from the reflecting surface with the point G, which in this case is the imaginary focus of the incident rays FC and AB.

It is not here, as in the case of rays passing through a plane surface, where some of the refracted rays proceed as from one point, and some as from another: but they all proceed after reflection as from one and the same point, however obliquely they may fall upon the surface; for what is here demonstrated of the ray AC holds equally of any other, as AI, AK, &c.

The case of parallel rays incident on a plane surface is included in this proposition: for in that case we are to suppose the radiant point infinitely distant from the surface, and then by the proposition the focus of the reflected rays will be so too: that is, the rays will be parallel after reflection, as they were before it.

Prop. II.

Of the reflection of parallel rays from a spherical surface.

When parallel rays are incident upon a spherical surface, the focus of the reflected rays will be the middle point between the centre of convexity and the surface.

This proposition admits of two cases.

Case 1. *Of parallel rays falling upon a convex surface.*

Let AB, DH, represent two parallel rays incident on the convex surface BH, the one perpendicularly, the other obliquely; and let C be the centre of convexity. Suppose HE to be the reflected ray of the oblique one DH, proceeding as from F, a point in the line AB produced. Through the point H draw the line CI, which will be perpendicular to the surface at that point; and the angles DHI and IHE, being the angles of incidence and reflection, will be equal. But HCF=DHI, the lines AC and DH being parallel; and CHF=IHE, wherefore the triangle CFH is isosceles, and consequently CF=FH: but supposing BH to vanish, FH=FB; and therefore upon this supposition FC=FB; that is, the focus of the reflected rays is the middle point between the centre of convexity and the surface. Fig. 4.

Case 2. *Of parallel rays falling upon a concave surface.*

Let AB, DH, be two parallel rays incident, the one perpendicularly, the other obliquely, on the concave surface BH, whose centre of concavity is C. Let BF and HF be the reflected rays meeting each other in F; this will be the middle point between B and C. For drawing through C the perpendicular CH, the angles DHC=FHC, being the angles of incidence and reflection; but HCF=DHC its alternate angle, and therefore the triangle CFH is isosceles. Wherefore CF=FH: but if we suppose BH to vanish, FB=FH, and therefore Fig. 5.

therefore CF=FB; that is, the focal distance of the reflected rays is the middle point between the centre and the surface.

It is here observable, that the farther the line DH, either in fig. 4. or 5. is taken from AB, the nearer the point F falls to the surface. For the farther the point H recedes from B, the greater the triangle CFH will become; and consequently, since it is always isosceles, and the base CH, being the radius, is everywhere of the same length, the equal legs CF and FH will lengthen; but CF cannot grow longer unless the point F approach towards the surface. And the farther H is removed from B, the faster F approaches to it.

This is the reason, that whenever parallel rays are considered as reflected from a spherical surface, the distance of the oblique ray from the perpendicular one is taken so small with respect to the focal distance of that surface, that without any physical error it may be supposed to vanish.

173 Reflected rays from a spherical surface never proceed from the same point. Fig 6.

Hence it follows, that if a number of parallel rays, as AB, CD, EG, &c. fall upon a convex surface, and if BA, DK, the reflected rays of the incident ones AB, CD, proceed as from the point F, those of the incident ones CD, EG, viz. DK, GL, will proceed as from N, those of the incident ones EG, HI, as from O, &c. because the farther the incident ones CD, EG, &c. are from AB, the nearer to the surface are the points F, *f*, *f*, in the line BF, from which they proceed after reflection; so that properly the foci of the reflected rays BA, DK, GL, &c. are not in the line AB produced, but in a curve line passing through the points F, N, O, &c.

The same is applicable to the case of parallel rays reflected from a concave surface, as expressed by the dotted lines on the other half of the figure, where PQ, RS, TV, are the incident rays; QF, S*f*, V*f*, the reflected ones, intersecting each other in the points X, Y, and F; so that the foci of those rays are not in the line FB, but in a curve passing through those points.

174 Rays proceeding from one point, and falling on a parabolic concave surface, are all reflected from one point.

Had the surface BH in fig. 4. or 5. been formed by the revolution of a parabola about its axis having its focus in the point F, all the rays reflected from the convex surface would have proceeded as from the point F, and those reflected from the concave surface would have fallen upon it, however distant their incident ones AB, DH, might have been from each other. For in the parabola, all lines drawn parallel to the axis make angles with the tangents to the points where they cut the parabola (that is, with the surface of the parabola) equal to those which are made with the same tangents by lines drawn from thence to the focus; therefore, if the incident rays describe those parallel lines, the reflected ones will necessarily describe these other, and so will all proceed as from, or meet in, the same point.

Prop. III.

175 Proportional distance of the focus of rays reflected from a spherical surface.

Of the reflection of diverging and converging rays from a spherical surface.

When rays fall upon any spherical surface, if they diverge, the distance of the focus of the reflected rays from the surface is to the distance of the radiant point from the same (or, if they converge, to that of the imaginary focus of the incident rays), as the distance of the focus of the reflected rays from the centre is to the distance of the radiant point (or imaginary focus of the incident rays) from the same.

This proposition admits of ten cases.

Case 1. *Of diverging rays falling upon a convex surface.*

Let RB, RD, represent two diverging rays flowing from the point R as from a radiant, and falling the one perpendicularly, the other obliquely, on the convex surface BD, whose centre is C. Let DE be the reflected ray of the incident one RD; produce ED to F, and through R draw the line RH parallel to FE till it meets CD produced in H. Then RHD=EDH the angle of reflection, and RHD=RDH the angle of incidence; wherefore the triangle DRH is isosceles, and DR=RH. Now the lines FD and RH being parallel, the triangles FDC and RHC are similar, or the sides are cut proportionably, and therefore FD : RH or RD=CF : CR; but BD vanishing, FD and RD differ not from FB and RB: wherefore FB : RB=CF : CR; that is, the distance of the focus from the surface is to the distance of the radiant point from the same, as the distance of the the focus from the centre is to the distance of the radiant point from it. Fig. 7.

Case 2. *Of converging rays falling upon a concave surface.*

Let KD and CB be the converging incident rays, having their imaginary focus in the point R, which was the radiant point in the foregoing case. Then as RD was in that case reflected into DE, KD will in this be reflected into DF; for, since the angles of incidence in both cases are equal, the angles of reflection will be equal also; so that F will be the focus of the reflected rays: but it was there demonstrated, that FB : RB= CF : CR; that is, the distance of the focus from the surface is to the distance (in this case) of the imaginary focus of the incident rays, as the distance of the focus from the centre is to the distance of the imaginary focus of the incident rays from the same.

Case 3. *Of converging rays falling upon a convex surface, and tending to a point between the focus of parallel rays and the centre.*

Let B represent a convex surface whose centre is C, and whose focus of parallel rays is P; and let AB, KD, be two converging rays incident upon it, and having their imaginary focus at R, a point between P and C. Now because KD tends to a point between the focus of parallel rays and the centre, the reflected ray DE will diverge from some point on the other side the centre, suppose F; as explained above. Through D draw the perpendicular CD, and produce it to H; then will KDH=HDE, being the angles of incidence and reflection, and consequently RDC=CDF too. Therefore the triangle RDF is bisected by the line DC: wherefore (3 El. 6.) FD and DR, or BD vanishing, FB : BR=FC : CR; that is, the distance of the focus of the reflected rays is to that of the imaginary focus of the incident ones, as the distance of the former from the centre is to the distance of the latter from the centre. Fig. 8.

Case 4. *Of diverging rays falling upon a concave surface, and proceeding from a point between the focus of parallel rays and the centre.*

Let RB, RD, be the diverging rays incident upon the concave surface BD, having their radiant point in R, Fig. 8.

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R, the imaginary focus of the incident rays in the preceding case. Then as KD was in that case reflected into DE, RD will now be reflected into DF. But we had FB : RB=CF : CR; that is, the distance of the focus is to that of the radiant, as the distance of the former from the centre is to the distance of the latter from the centre.

The angles of incidence and reflection being equal, it is evident, that if, in any case, the reflected ray be made the incident one, the incident will become the reflected one; and therefore the four following cases may be considered respectively as the converse of the four preceding; for in each of them the incident rays are supposed to coincide with the reflected ones in the other. Or they may be thus demonstrated independently of them.

CASE 5. *Of converging rays falling upon a convex surface, and tending to a point nearer the surface than the focus of parallel rays.*

Fig. 7. Let ED, RB be the converging rays incident upon the convex surface BD, whose centre is C, and principal focus P; let the imaginary focus of the incident rays be at F, a point between P and B; and let DR be the reflected ray. From C and R draw the lines CH, RH, the one passing through D, the other parallel to FE. Then RHD=HDE the angle of incidence. But RHD=HDR, the angle of reflection: wherefore the triangle HDR is isosceles, and DR=RH. Now the lines FD and RH being parallel, the triangles FDC and RHC are similar; and therefore RH or RD : FD=CR : CF; but BD vanishing, RD and FD coincide with RB and FB, wherefore RB : FB=CR : CF; that is, the distance of the focus from the surface is to the distance of the imaginary focus of the incident rays, as the distance of the focus from the centre is to the distance of the imaginary focus of the incident rays from the centre.

CASE 6. *Of diverging rays falling upon a concave surface, and proceeding from a point between the focus of parallel rays and the surface.*

Let FD and BF be two rays diverging from the point F, which was the imaginary focus of the incident rays in the preceding case. Then as ED was in that case reflected into DR, FD will be reflected into DK (for the reason mentioned in case 2.), so that the reflected ray will proceed as from the point R: but it was demonstrated in case 5. that RB : FB=CR : CF; that is, the distance of the focus from the surface is to that of the radiant from the surface, as the distance of the former from the centre is to that of the latter from the centre.

Fig. 8. CASE 7. *Of converging rays falling upon a convex surface, and tending towards a point beyond the centre.*

Let AB, ED be the incident rays tending to F, a point beyond the centre C, and let DK be the reflected ray of the incident one ED. Then because the incident ray ED tends to a point beyond the centre, the reflected ray DK will proceed as from one on the contrary side, suppose R; see Prop. vii. Through D draw the perpendicular CD, and produce it to H. Then will EDH=HDK, being the angles of incidence and reflection; but CDF=CDR, being their verticals: consequently the angle FDR is bisected by the line CD; wherefore RD : DF, or (3 Elem. 6.) BD vanishing, RB : BF=RC : CF; that is, the distance of the focus of the reflected rays is to that of the imaginary focus of the incident rays, as the distance of the former from the centre is to the distance of the latter from the centre.

CASE 8. *Of diverging rays falling upon a concave surface, and proceeding from a point beyond the centre.*

Let FB, FD be the incident rays radiating from F, the imaginary focus of the incident rays in the case. Then as ED was in that case reflected into DK, FD will now be reflected into DR; so that R will be the focus of the reflected rays. But it was demonstrated in the case 7. that RB : FB=RC : CF; that is, the distance of the focus of the reflected rays from the surface is to the distance of the radiant from the surface, as the distance of the focus of the reflected rays from the centre is to the distance of the radiant from the centre.

The two remaining cases may be considered as the converse of those under Prop. ii. (p. 234.), because the incident rays in these are the reflected ones in them; or they may be demonstrated in the same manner with the preceding, as follows.

CASE 9. *Converging rays falling upon a convex surface, and tending to the focus of parallel rays, become parallel after reflection.*

Let ED, RB represent two converging rays incident on the convex surface BD, and tending towards F, which we shall now suppose to be the focus of parallel rays; and let DR be the reflected ray, and C the centre of convexity of the reflecting surface. Through C draw CD, and produce it to H, drawing RH parallel to ED produced to F. Now it has been demonstrated (case 5. where the incident rays are supposed to tend to the point F), that RB : FB=RC : CF; but F in this case being supposed to be the focus of parallel rays, it is the middle point between C and B (by Prop. ii.) and therefore FB=FC, consequently RB=RC; which can only be upon the supposition that R is at an infinite distance from B; that is, that the reflected rays BR and DR be parallel. Plate CCCLXXXIII. fig. 7.

CASE 10. *Diverging rays falling upon a concave surface, and proceeding from the focus of parallel rays, become parallel after reflection.*

Let RD, RB be two diverging rays incident upon the concave surface BD, as supposed in case 4. where it was demonstrated that FB : RB=CF : CR. But in the present case RB=CR, because R is supposed to be the focus of parallel rays; therefore FB=FC; which cannot be unless F be taken at an infinite distance from B; that is, unless the reflected rays BF and DF be parallel. Fig. 5.

It may here be observed that in the case of diverging rays falling upon a convex surface, the farther the point D is taken from B, the nearer the point F, the focus of the reflected rays, approaches to B, while the radiant point R remains the same. For it is evident from the curvature of a circle, that the point D may be taken so far from B, that the reflected ray DE shall proceed as from F, G, H, or even from B, or from any point between B and R; and the farther it is taken from B, the faster the point from which it proceeds approaches towards R: as will appear if we draw several incident rays with their respective reflected ones, in such a manner that the angles of reflection may be equal to their respective angles of incidence, as is done in the figure. The like is applicable to any of the other cases of diverging and converging rays incident upon a spherical surface. This is the reason, that, when rays are considered as reflected from a spherical surface, Fig. 9. Fig. 10.

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surface, the distance of the oblique rays from the perpendicular one is taken so small, that it may be supposed to vanish.

From this it follows, that if a number of diverging rays are incident upon the convex surface BD at the several points B, D, D, &c. they will not proceed after reflection as from any point in the line RB produced, but as from a curve line passing through the several points F, *f*, *f*, &c.

Fig. 7. Had the curve BD been a hyperbola, having its foci in R and F, then R being the radiant (or the imaginary focus of incident rays), F would have been the focus of the reflected ones, and *vice versa*, however distant the points B and D might be taken from each other. In

Fig. 8. like manner, had the curve BD been an ellipse having its foci in F and R, the one of these being made the radiant (or imaginary focus of incident rays), the other would have been the focus of reflected ones, and *vice versa*. For both in the hyperbola and ellipse, lines drawn from each of their foci through any point make equal angles with the tangent to that point. Therefore, if the incident rays proceed to or from one of their foci, the reflected ones will all proceed as from or to the other focus. Therefore, in order that diverging or converging rays may be accurately reflected to or from a point, the reflecting surface must be formed by the revolution of an *hyperbola* about its longer axis, when the incident rays are such, that their radiant or imaginary focus of incident rays shall fall on one side of the surface, and the focus of the reflected ones on the other; when they are both to fall on the same side, it must be formed by the revolution of an *ellipse* about its longer axis. However, as spherical surfaces are more easily formed, than those which are generated by the revolution of any of the conic sections about their axes, the latter are very rarely used.

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Method of finding the focal distance of rays reflected from a convex surface.

Now, because the focal distance of rays reflected from a spherical surface cannot be found by the analogy laid down in the third proposition, without making use of the quantity sought; we shall here give an example whereby the method of doing it in all others will readily appear.

Problem.

Let it be required to find the focal distance of diverging rays incident upon a convex surface, whose radius of convexity is five parts, and the distance of the radiant from the surface is 20.

Call x the focal distance sought; then will the distance of the focus from the centre be $5-x$, and that of the radiant from the same 25, therefore by Prop. iii. we have the following proportion, $x : 20 = 5-x : 25$; and multiplying extremes together and means together, we have $25\,x = 100 - 20x$, or $x = \frac{100}{45}$.

If it should happen in any case that the value of x is a negative quantity, the focal point must then be taken on the contrary side of the surface to that on which it was supposed it would fall in stating the problem.

Because it was observed in the preceding section, that different incident rays, though tending to or from one point, would after refraction proceed to or from different points, a method was there given of determining the distinct point which each separate ray entering a spherical surface converges to, or diverges from, after refraction: the same has been observed here with regard to rays reflected from a spherical surface (see case 2. and case 10.) But the method of determining the distinct point to or from which any incident ray proceeds after reflection, is much more simple. It is only necessary to draw the reflected ray such, that the angle of reflection may be equal to the angle of incidence, which will determine the point it proceeds to or from in any case whatever.

Appearance of Bodies seen by Reflection.

Sect. VIII. *Of the Appearance of Bodies seen by Light reflected from plane and spherical Surfaces.*

Whatever has been said concerning the appearance of bodies seen through lenses, by refracted light, respects also the appearance of bodies seen by reflection. But, besides these, there is one thing peculiar to images by reflection, viz. that each point in the representation of an object made by reflection appears situated somewhere in a right line that passes through its correspondent point in the object, and is perpendicular to the reflecting surface.

The truth of this appears sufficiently from the propositions formerly laid down: in each of which, rays flowing from any radiant point, are shown to proceed after reflection to or from some point in a line that passes through the radiant point, and is perpendicular to the reflecting surface. For instance (fig. 1.) rays flowing from Y are collected in X, a point in the perpendicular CD, which, being produced, passes through Y; Plate CCCLXXXII. fig. 2.
again (fig. 2.), rays flowing from G, proceed, after reflection, as from N, a point in the perpendicular CD, which being produced, passes through G.

This observation, however, except where an object is seen by reflection from a plain surface, relates only to those cases where the representation is made by means of such rays as fall upon the reflecting surface with a very small degree of obliquity; because such as fall at a considerable distance from the perpendicular, do not proceed after reflection as from any point in that perpendicular, but as from other points situated in a certain curve, on which account these rays are neglected, as making an indistinct and deformed representation. And therefore it is to be remembered, that however the situation of the eye with respect to the object and reflecting surface may be represented in the following figures, it is to be supposed as situated in such a manner with respect to the object, that rays flowing from thence and entering it after reflection, may be such only as fall with a very small degree of obliquity upon the surface; that is, the eye must be supposed to be placed almost directly behind the object, or between it and the reflecting surface. The reason why it is not always so placed, is only to avoid confusion in the figures.

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The appearance of objects reflected from plane surfaces.

I. *When an object is seen by reflection from a plane surface, the image of it appears at the same distance behind the surface that the object is before it, of the same magnitude, and directly opposite to it.*

Fig. 10. To explain this, let AB represent an object seen by reflection from the plane surface SV; and let the rays AF, AG, be so inclined to the surface, that they shall enter an eye at H after reflection; and let AE be perpendicular to the surface: then, by the observation just mentioned, the point A will appear in some part of the line AE produced, suppose I; that is, the oblique rays AF

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AF and AG will proceed after reflection as from that point; and further, because the reflected rays FH, GK, will have the same degree of inclination to one another that their incident ones have, that point must necessarily be at the same distance from the surface that the point A is; the representation therefore of the point A will be at the same distance from the surface that the point itself is before it, and directly opposite to it: consequently, since the like may be shown of any other point B, the whole image IM will appear at the same distance behind the surface that the object is before it, and directly opposite to it; and because the lines AI, BM, perpendicular to the plain surface, are parallel to each other, the image will also be of the same magnitude with the object.

178 From convex surfaces.

II. *When an object is seen by reflection from a convex surface, its image appears nearer to the surface, and less than the object.*

Fig. 12.

Let AB represent the object, SV a reflecting surface whose centre of convexity is C: and let the rays AF, AG, be so inclined to the surface, that after reflection from it, they shall enter the eye at H: and let AE be perpendicular to the surface; then will the oblique rays AF, AG, proceed after reflection as from some point in the line AE produced, suppose from I; which point, because the reflected rays will diverge more than the incident ones, must be nearer to the surface than the point A. And since the same is also true of the rays which flow from any other B, the representation IM will be nearer to the surface than the object; and because it is terminated by the perpendiculars AE and BF, which incline to each other, as concurring at the centre, it will also appear less.

179 From concave surfaces.

III. *When an object is seen by reflection from a concave surface, the representation of it is various, both with regard to its magnitude and situation, according as the distance of the object from the reflecting surface is greater or less.*

1. When the object is nearer to the surface than its principal focus, the image falls on the opposite side of the surface, is more distant from it, and larger than the object.

Fig. 13.

Thus let AB be the object, SV the reflecting surface, F the principal focus, and C its centre. Through A and B, the extremities of the object, draw the lines CE, CR, which will be perpendicular to the surface; and let the rays AR, AG, be incident upon such points of it that they shall be reflected into an eye at H. Now, because the radiant points A and B are nearer the surface than the principal focus F, the reflected rays will diverge, and therefore proceed as from some points on the opposite side of the surface; which points, by the observation laid down at the beginning of this section, will be in the perpendiculars AE, BR, produced, suppose in I and M: but they will diverge in a less degree than their incident ones: and therefore the said points will be farther from the surface than the points A and B. The image therefore will be on the opposite side of the surface with respect to the object: it will be more distant than it; and consequently, being terminated by the perpendiculars CI and CM, it will also be larger.

2. When the object is placed in the principal focus, the reflected rays enter the eye parallel; in which case the image ought to appear at an infinite distance behind the reflecting surface; but the representation of it, for the reasons given in the foregoing case, being large and distinct, we do not reckon it much farther from the surface than the image.

3. When the object is placed between the principal focus and the centre, the image falls on the opposite side of the centre, is larger than the object, and in an inverted position.

Plate CCLXXXII. fig. 14.

Thus let AB be the object, SV the reflecting surface, F its principal focus, and C its centre. Through A and B, draw the lines CE and CN, which will be perpendicular to the surface; and let AR, AG, be a pencil of rays flowing from A. These rays proceeding from a point beyond the principal focus, will after reflection converge towards some point on the opposite side the centre, which will fall upon the perpendicular EC produced, but at a greater distance from C than the radiant A from which they diverged. For the same reason, rays flowing from B will converge to a point in the perpendicular NC produced, which shall be farther from C than the point B; whence it is evident, that the image IM is larger than the object AB, that it falls on the contrary side of the centre, and that their positions are inverted with respect to each other.

4. If the object be placed beyond the centre of convexity, the image is then formed between the centre and the focus of parallel rays, is less than the object, and its position is inverted.

This proposition is the converse of the preceding; for as in that case rays proceeding from A were reflected to I, and from B to M; so rays flowing from I and M will be reflected to A and B: if therefore an object be supposed to be situated beyond the centre in IM, the image of it will be formed in AB between that and the focus of parallel rays, will be less than the object, and inverted.

5. If the middle of the object be placed in the centre of convexity of the reflecting surface, the object and its image will be coincident; but the image will be inverted with respect to the object.

That the place of the image and the object should be the same in this case requires little explication; for the middle of the object being in the centre, rays flowing from it will fall perpendicularly upon the surface, and therefore necessarily return thither again; so that the middle of the image will be coincident with the middle of the object. But that the image should be inverted is perhaps not so clear. To explain this, let AB be the object, having its middle point C in the centre of the reflecting surface from SV; through the centre and the point R draw the line CR, which will be perpendicular to the reflecting surface; join the points AR and BR, and let AR represent a ray flowing from A; this will be reflected into RB; for C being the middle point between A and B, the angle ARC=CRB; and a ray from B will likewise be reflected to A; and therefore the position of the image will be inverted with respect to that of the object. Fig. 15.

In this proposition it is to be supposed, that the object AB is so situated with respect to the reflecting surface, that the angle ACR may be right; for otherwise the angles ARC and BRC will not be equal, and part of the image only will therefore fall upon the object.

6. If

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6. If in any of the three last cases, in each of which the image is formed on the same side of the reflecting surface with the object, the eye be situated farther from the surface than the place where the image falls, the rays of each pencil, crossing each other in the several points of the image, will enter the eye as from a real object situated there; so that the image will appear pendulous in the air between the eye and the reflecting surface, and in the position wherein it is formed, viz. inverted with respect to the object, in the same manner that an image formed by refracted light appears to an eye, placed beyond it; which was fully explained under Prop. iv. and therefore needs not be repeated.

But as what relates to the appearance of the object when the eye is placed nearer to the surface than the image, was not there fully inquired into, that point shall now be more strictly examined under the following case, which equally relates to refracted and reflected light.

7. If the eye be situated between the reflecting surface and the place of the image, the object is then seen beyond the surface; and the farther the eye recedes from the surface towards the place of the image, the more confused, larger, and nearer, the object appears.

Fig. 16. To explain this, let AB represent the object; IM its image, one of whose points M is formed by the concurrence of the reflected rays DM, EM, &c. which before reflection came from B; the other, I, by the concurrence of DI, EI, &c. which came from A: and let *a b* be the pupil of an eye, situated between the surface DP and the image. This pupil will admit the rays H *a*, K *b*; which, because they are tending towards I, are such as came from A, and therefore the point A will appear diffused over the space RS. In like manner the pupil will also receive into it the reflected rays K *a* and L *b*, which, because they are tending towards M, by supposition came from B; and therefore the point B will be seen spread as it were over the space TV, and the object will seem to fill the space RV; but the representation of it will be confused, because the intermediate points of the object being equally enlarged in appearance, there will not be room for them between the points S and T, but they will coincide in part one with another: for instance, the appearance of that point in the object, whose representation falls upon *c* in the image, will fill the space *m n*; and so of the rest. Now, if the same pupil be removed into the situation *e f*, the reflected rays E *e* and G *f* will then enter the eye, and therefore one extremity of the object will appear to cover the space XY; and because the rays O *f* and L *e* will also enter it in their progress towards M, the point B, from which they came, will appear to cover ZV; the object therefore will appear larger and more confused than before. When the eye recedes quite to the image, it sees but one single point of the object, and that appears diffused all over the reflecting surface: for instance, if the eye recedes to the point M, then rays flowing from the point B enter it upon whatever part of the surface they fall. The object also appears nearer to the surface the farther the eye recedes from it towards the place of the image; probably because, as the appearance of the object becomes more and more confused, its place is not so easily distinguished from that of the reflecting surface itself, till at last when it is quite confused (as it is when the eye is arrived at M) they both appear as one, the surface assuming the colour of the object.

180. The apparent magnitude of an object seen by reflection from a concave surface.

As to the precise apparent magnitude of an object seen after this manner, it is such that the angle it appears under shall be equal to that which the image of the same object would appear under were we to suppose it seen from the same place: that is, the apparent object (for such we must call it, to distinguish it from the image of the same object) and the image subtend equal angles at the eye.

Here we must suppose the pupil of the eye to be a point only, because the magnitude of it causes a small alteration in the apparent magnitude of the object. Let the point *a* represent the pupil, then will the extreme rays that can enter it be H *a* and K *a*; the object therefore will appear under the angle H *a* K = M *a* I, the angle under which the image IM would appear were it to be seen from *a*. Again, if the eye be placed in *f*, the object appears under the angle G *f* O = I *f* M, which the image subtends at the same place, and therefore the apparent object and image of it subtend equal angles at the eye.

Now if we suppose the pupil to have any sensible magnitude *a b*; then the object seen by the eye in that situation will appear under the angle HXL, which is larger than the angle H *a* K, under which it appeared before; because the angle at X is nearer than the angle at *a*, to the line IM, which is a subtense common to them both.

From this proposition it follows; that, were the eye close to the surface at K, the real and apparent object would be seen under equal angles (for the real object appears from that place under the same angle that the image does, as will be shown at the end of this section); therefore, when the eye is nearer to the image than that point, the image will subtend a larger angle at it than the object does; and consequently, since the image and apparent object subtend equal angles at the eye, the apparent object must necessarily be seen under a larger angle than the object itself, wherever the eye be placed, between the surface and the image.

As each point in the representation of an object made by reflection is situated somewhere in a right line that passes through its correspondent point in the object, and is perpendicular to the reflecting surface; we may hence deduce the following easy and expeditious method of determining both the magnitude and situation of the image in all cases whatever.

Plate CCCLXXXII. Fig. 17, 18, 19.

Though the extremities of the object AB and the centre C (fig. 17, 18, 19.) draw the lines AC BC, and produce them as the case requires; these lines will be perpendicular to the reflecting surface, and therefore the extremities of the image will fall upon them. Through F the middle point of the object and the centre, draw the line FC, and produce it till it passes through the reflecting surface; this will also be perpendicular to the surface. Through G, the point where this line cuts the surface, draw the lines AG and BG, and produce them this way or that, till they cross the former perpendiculars; and where they cross, there I and M the extremities of the image will fall. For supposing AG to be a ray proceeding from the point A and

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and falling upon G, it will be reflected to B; because FA=FB, and FG is perpendicular to the reflecting surface; and therefore the representation of the point A will be in BG produced as well as in AC; consequently it will fall on the point I, where they cross each other. Likewise the ray BG will for the same reason be reflected to A; and therefore the representation of the point B will be in AG produced, as well as in some part of BC, that is, in M where they cross. Hence the proposition is obvious.

If it happens that the lines will not cross which way soever they are produced, as in fig. 20. then is the object in the focus of parallel rays of that surface, and has no image formed in the place whatever. For in this case the rays AH, AG, flowing from the point A, become parallel after reflection in the lines HC, GB, and therefore do not flow as to or from any point: in like manner, rays flowing from B are reflected into the parallel lines KB and GA; so that no representation can be formed by such reflection.

From this we learn another circumstance relating to the magnitude of the image made by reflection; viz. that it subtends the same angle at the vertex of the reflecting surface that the object does. This appears by inspection of the 17th, 18th, or 19th figure, in each of which the angle IGM=AGB, the angles which the image subtends at G the vertex of the reflecting surface, and which the object subtends at the same place; for in the two first of those figures they are vertical, in the third they are the same.

The angle ICM, which the image subtends at the centre, is also equal to the angle ACB which the object subtends at the same place; for in the two first figures they are the same, in the last they are vertical to each other.

Whence it is evident, that the object and its image are to each other in diameter, either as their respective distances from the vertex of the reflecting surface, or as their distances from the centre of the same.

IV. *As objects are multiplied by being seen through transparent media, whose surfaces are properly disposed, so they may also by reflecting surfaces.*

Plate CCCLXXXII. fig. 21.

1. If two reflecting surfaces be disposed at right angles, as the surfaces AB, BC, an object at D may be seen by an eye at E, after one reflection at F, in the line EF produced; after two reflections, the first at G, the second at H, in the line EH produced; and, also, after one reflection made at A, in the line EA produced.

Fig. 22.

2. If the surfaces be parallel, as AB, CD, (fig. 22.), and the object be placed at E and the eye at F, the object will appear multiplied an infinite number of times: thus it may be seen in the line FG produced, after one reflection at G; in the line FH produced, after two reflections, the first at I, the second at H; and also in FP produced, after several successive reflections of the ray EL, at the points L, M, N, O, and P: and so on *in infinitum*. But the greater the number of reflections are, the weaker their representation will be.

Sect. IX. *Of the apparent Place, Distance, Magnitude, and Motion of Objects.*

Apparent place, &c. of objects.

It had in general been taken for granted, that the place to which the eye refers any visible object seen by reflection or refraction, is that in which the visual rays meet a perpendicular from the object upon the reflecting or refracting plane. But this method of judging of the place of objects was called in question by Dr Barrow, who contended that the arguments brought in favour of the opinion were not conclusive. 181

Dr Barrow's theory respecting the apparent place of objects.

These arguments are, that the images of objects appeared straight in a plane mirror, but curved in a convex or concave one: that a straight thread, when partly immersed perpendicularly in water, does not appear crooked as when it is obliquely plunged into the fluid; but that which is within the water seems to be a continuation of that which is without. With respect to the reflected image, however, of a perpendicular right line from a convex to a concave mirror, he says, that it is not easy for the eye to distinguish the curve that it really makes; and that if the appearance of a perpendicular thread, part of which is immersed in water, be closely attended to, it will not favour the common hypothesis. If the thread is of any shining metal, as silver, and viewed obliquely, the image of the part immersed will appear to detach itself sensibly from that part which is without the water, so that it cannot be true that every object appears to be in the same place where the refracted ray meets the perpendicular; and the same observation, he thinks, may be extended to the case of reflection. According to Dr Barrow, we refer every point of an object to the place from which the pencils of light, that give us the image of it, issue, or from which they would have issued if no reflecting or refracting substance intervened. Pursuing this principle, he proceeds to investigate the place in which the rays issuing from each of the points of an object, and which reach the eye after one reflection or refraction, meet; and he found, that if the refracting surface was plane, and the refraction was made from a denser medium into a rarer, those rays would always meet in a place between the eye and a perpendicular to the point of incidence. If a convex mirror be used, the case will be the same; but if the mirror be plane, the rays will meet in the perpendicular, and beyond it if it be concave. He also determined, according to these principles, what form the image of a right line will take, when it is presented in different manners to a spherical mirror, or when it is seen through a refracting medium.

Though Dr Barrow reckoned the maxim which he endeavoured to establish, concerning the supposed place of visible objects, highly probable, he has the candour to mention an objection to it, of which he was not able to give a satisfactory solution. It is this. Let an object be placed beyond the focus of a convex lens; and if the eye be close to the lens, it will appear confused, but very near to its true place. If the eye be a little withdrawn, the confusion will increase, and the object will seem to come nearer; and when the eye is near the focus, the confusion will be exceedingly great, and the object will seem to be close to the eye. But in this experiment the eye receives no rays but those that are converging: and the point from which they issue is so far from being nearer than the object, that it is beyond it; notwithstanding which, the object is conceived to be much nearer than it is, though no very distinct idea can be formed of its precise distance. It may be observed, that in reality, the rays falling upon the eye in this case in

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in a manner quite different from that in which they fall upon it in other circumstances, we can form no judgement about the place from which they issue. This subject was afterwards taken up by Berkeley, Smith, Montucla, and others.

182 M. de la Hire's observations.

M. de la Hire made several observations concerning the distance of visible objects, and various other phenomena of vision, which are worthy of notice. He also took particular pains to ascertain the manner in which the eye conforms itself to the view of objects placed at different distances. He enumerates five circumstances, which assist us in judging of the distance of objects, namely their apparent magnitude, the strength of the colouring, the direction of the two eyes, the parallax of the objects, and the distinctness of their small parts. Painters, he says, can only take advantage of the two first-mentioned circumstances, and therefore pictures can never perfectly deceive the eye; but in the decorations of theatres, they, in some measure, make use of them all. The size of objects, and the strength of their colouring, are diminished in proportion to the distance at which they are intended to appear. Parts of the same object which are to appear at different distances, as columns in an order of architecture, are drawn upon different planes a little removed from one another, that the two eyes may be obliged to change their direction, in order to distinguish the parts of the nearer plane from those of the more remote. The small distance of the planes serves to make a small parallax, by changing the position of the eye; and as we do not preserve a distinct idea of the quantity of parallax, corresponding to the different distances of objects, it is sufficient that we perceive there is a parallax, to be convinced that these planes are distant from one another, without determining what that distance is; and as to the last circumstance, viz. the distinctness of the small parts of objects, it is of no use in discovering the deception, on account of the false light that is thrown upon these decorations.

183 M. le Cat's account of the largeness of objects in mist.

To these observations concerning deception of sight, we shall add a similar one of M. le Cat, who took notice that the reason why we imagine objects to be larger when they are seen through a mist, is the dimness or obscurity with which they are then seen; this circumstance being associated with the idea of great distance. This, he says, is confirmed by our being surprised to find, upon approaching such objects, that they are so much nearer to us, as well as so much smaller, than we had imagined.

Among other cases concerning vision, which fell under the consideration of M. de la Hire, he mentions one which it is difficult to solve. It is when a candle, in a dark place, and situated beyond the limits of distinct vision, is viewed through a very narrow chink in a card; in which case a considerable number of candles, sometimes so many as six, will be seen along the chink. This appearance he ascribes to small irregularities in the surface of the humours of the eye, the effect of which is not sensible when rays are admitted into the eye through the whole extent of the pupil, and consequently one principal image effaces a number of small ones; whereas, in this case, each of them is formed separately, and no one of them is so considerable as to prevent the others from being perceived at the same time.

There are few persons, M. de la Hire remarks, who have both their eyes exactly equal, not only with respect to the limits of distinct vision, but also with regard to the colour with which objects appear tinged when they are viewed by them, especially if one of the eyes has been exposed to the impression of a strong light. To compare them together in this respect, he directs us to take two thin cards, and to make in each of them a round hole of a third or a fourth of a line in diameter, and, applying one of them to each of the eyes, to look through the holes on a white paper, equally illuminated, when a circle of the paper will appear to each of the eyes, and, placing the cards properly, these two circles may be made to touch one another, and thereby the appearance of the same object to each of the eyes may be compared to the greatest advantage. To make this experiment with exactness, it is necessary, he says, that the eyes be kept shut some time before the cards be applied to them.

By the following calculation, M. de la Hire gives us an idea of the extreme sensibility of the optic nerves. One may see very easily, at the distance of 4000 toises, the sail of a wind mill, 6 feet in diameter; and the eye being supposed to be an inch in diameter, the picture of this sail, at the bottom of the eye, will be $\frac{1}{8000}$ of an inch, which is less than the 666th part of a line, and is about the 66th part of a common hair, or the 8th part of a single thread of silk. So small, therefore, must one of the fibres of the optic nerve be, which, he says, is almost inconceivable, since each of these fibres is a tube that contains spirits.

184 Berkeley's account of the judgement formed concerning distance by confused vision.

The person who particularly noticed Dr Barrow's hypothesis was the ingenious Dr Berkeley, bishop of Cloyne, who distinguished himself so much by the objections which he started to the reality of a material world, and by his opposition to the Newtonian doctrine of fluxions. In his Essay towards a new Theory of Vision, he observes, that the circle formed upon the retina, by the rays which do not come to a focus, produce the same confusion in the eye, whether they cross one another before they reach the retina, or tend to do it afterwards; and therefore that the judgment concerning distance will be the same in both the cases, without any regard to the place from which the rays originally issued; so that in this case, as, by receding from the lens, the confusion, which always accompanies the nearness of an object, increases, the mind will judge that the object comes nearer.

185 Smith's account.

But, says Dr Smith, if this be true, the object ought always to appear at a less distance from the eye than that at which objects are seen distinctly, which is not the case: and to explain this appearance, as well as every other in which a judgment is formed concerning distance, he maintains, that we judge of it chiefly if not only by the apparent magnitude of objects, so that, since the image grows larger as we recede from the lens through which it is viewed, we conceive the object to come nearer. He also endeavours to show, that in all cases in which glasses are used, we judge of distance by the same rule; from which he concludes, that the apparent distance of an object seen in a glass is to its apparent distance seen by the naked eye, as the apparent magnitude in the naked eye is to its apparent magnitude in the glass.

But that we do not judge of distance merely by the angle

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angle under which objects are seen, is an observation as old as Alhazen, who mentions several instances, in which, though the angles under which objects appear be different, the magnitudes are universally and instantaneously deemed not to be so. Mr Robins clearly shows the hypothesis of Dr Smith to be contrary to fact in the most common and simple cases. In microscopes, he says, it is impossible that the eye should judge the object to be nearer than the distance at which it has viewed the object itself, in proportion to the degree of magnifying. For when the microscope magnifies much, this rule would place the image at a distance, of which the sight cannot possibly form any opinion, as being an interval from the eye at which no object can be seen. In general, he says, he believes, that whoever looks at an object through a convex glass, and then at the object itself without the glass, will find it to appear nearer in the latter case, though it be magnified in the glass; and in the same trial with the concave glass, though by the glass the object be diminished, it will appear nearer through the glass than without it.

186 Objected to by Mr Robins.

But the following experiment is the most convincing proof that the apparent distance of the image is not determined by its apparent magnitude. If a double convex glass be held upright before some luminous object, as a candle, there will be seen two images, one erect, and the other inverted. The first is made simply by reflection from the nearest surface, the second by reflection from the farther surface, the rays undergoing a refraction from the first surface both before and after the reflection. If this glass has not too short a focal distance when it is held near the object, the inverted image will appear larger than the other, and also nearer; but if the glass be carried off from the object, though the eye remain as near to it as before, the inverted image will diminish so much faster than the other, that, at length, it will appear very much less than it, but still nearer. Here, says Mr Robins, two images of the same object are seen under one view, and their apparent distances, when immediately compared, seem to have no necessary connexion with the apparent magnitude. He also shows how this experiment may be made still more convincing, by sticking a piece of paper on the middle of the lens, and viewing it through a short tube.

187 M. Bouguer adopts Dr Barrow's maxim.

M. Bouguer adopts the general maxim of Dr Barrow, in supposing that we refer objects to the place from which the pencils of rays seemingly converge at their entrance into the pupil. But when rays issue from below the surface of a vessel of water, or any other refracting medium, he finds that there are always two different places of this seeming convergence; one of them of the rays that issue from it in the same vertical circle, and therefore fall with different degrees of obliquity upon the surface of the refracting medium; and another, of those that fall upon the surface with the same degree of obliquity, entering the eye laterally with respect to one another. Sometimes, he says, one of these images is attended to by the mind, and sometimes the other, and different images may be observed by different persons. An object immersed in water affords an example, he says, of this duplicity of images.

Plate cccLxxxiv. fig. 1.

If BA *b* be part of the surface of water, and the object be at O, there will be two images of it in two different places; one at G, on the caustic by refraction, and the other at E, in the perpendicular AO, which is as much a caustic as the other line. The former image is visible by the rays ODM, O *d m*, which are one higher than the other, in their progress to the eye; whereas the image at E is made by the rays ODM, O *e f*, which enter the eye laterally. This, says he, may serve to explain the difficulty of Father Tacquet, Barrow, Smith, and many other authors.

G. W. Kraft has ably supported the opinion of Dr Barrow, that the place of any point, seen by reflection from the surface of any medium, is that in which rays issuing from it, infinitely near to one another, would meet; and considering the case of a distant object, viewed in a concave mirror, by an eye very near to it, when the image, according to Euclid and other writers, would be between the eye and the object, and the rule of Dr Barrow cannot be applied; he says that in this case the speculum may be considered as a plane, the effect being the same, only the image is more obscure.

188 Dr Porterfield's view of the subject.

Dr Porterfield gives a distinct view of the natural methods of judging concerning the distance of objects. The conformation of the eye, he observes, can be of no use to us with respect to objects placed without the limits of distinct vision. As the object, however, does then appear more or less confused, according as it is more or less removed from those limits, this confusion assists the mind in judging of the distance of the object; it being always estimated so much the nearer, or the farther off, as the confusion is greater. But this confusion hath its limits; for when an object is placed at a certain distance from the eye, to which the breadth of the pupil bears no sensible proportion, the rays of light that come from a point in the object, and pass the pupil, are so little diverging, that they may be considered as parallel. For a picture on the retina will not be sensibly more confused, though the object be removed to a much greater distance.

The most general, and frequently the most certain means of judging of the distance of objects is, he says, by the angle made by the optic axis. For our two eyes are like two different stations, by the assistance of which distances are taken; and this is the reason why those persons who are blind of one eye, so frequently miss their marks in pouring liquor into a glass, snuffing a candle, and such other actions as require that the distance be exactly distinguished. To be convinced of the utility of this method of judging of the distance of objects, he directs us to suspend a ring in a thread, so that its side may be towards us, and the hole in it to the right and left hand; and taking a small rod, crooked at the end, retire from the ring two or three paces and having with one hand covered one of our eyes, to endeavour with the other to pass the crooked end of the rod through the ring. This, says he, appears very easy; and yet, upon trial, perhaps once in 100 times we shall not succeed, especially if we move the rod a little quickly.

The use of this second method of judging of distances Dechales limited to 120 feet; beyond which, he says, we are not sensible of any difference in the angle of the optic axis.

A third method of judging of the distance of objects, consists in their apparent magnitudes, on which so much stress was laid by Dr Smith. From this change in the magnitude

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magnitude of the image upon the retina, we easily judge of the distance of objects, as often as we are otherwise acquainted with their magnitude; but as often as we are ignorant of the real magnitude of bodies, we can never, from their apparent magnitude, form any judgement of their distance.

Hence we may see why we are so frequently deceived in our estimates of distance, by any extraordinary magnitudes of objects seen at the end of it; as, in travelling towards a large city, or a castle, or a cathedral church, or a mountain larger than common, we fancy them to be nearer than they really are. This also is the reason why animals, and little objects, seen in valleys, contiguous to large mountains, appear exceedingly small. For we think the mountain nearer to us than if it were smaller; and we should not be surprised at the smallness of the neighbouring animals, if we thought them farther off. For the same reason, we think them exceedingly small, when they are placed upon the top of a mountain, or a large building; which appear nearer to us than they really are, on account of their extraordinary size.

189 Why objects seen from a high building appear smaller than they are.

Dr Jurin accounts for our imagining objects, when seen from a high building, to be smaller than they are, and smaller than we fancy them to be when we view them at the same distance on level ground. It is, says he, because we have no distinct idea of distance in that direction, and therefore judge of things by their pictures upon the eye only; but custom will enable us to judge rightly even in this case.

Let a boy, says he, who has never been upon any high building, go to the top of a lofty spire, and look down into the street; the objects seen there, as men and horses, will appear so small as greatly to surprise him. But 10 or 20 years after, if in the mean time he has used himself now and then to look down from that and other great heights, he will no longer find the same objects to appear so small. And if he were to view the same objects from such heights as frequently as he sees them upon the same level with himself in the streets, he supposes that they would appear to him just of the same magnitude from the top of the spire, as they do from a window one story high. For this reason it is, that statues placed upon very high buildings ought to be made of a larger size than those which are seen at a nearer distance; because all persons, except architects, are apt to imagine the height of such buildings to be much less than it really is.

The fourth method by which Dr Porterfield says that we judge of the distance of objects, is the force with which their colour strikes upon our eyes. For if we be assured that two objects are of a similar and like colour, and that one appears more bright and lively than the other, we judge that the brighter object is the nearer of the two.

The fifth method consists in the different appearance of the small parts of objects. When these parts appear distinct, we judge that the object is near; but when they appear confused, or when they do not appear at all, we reckon the object to be at a greater distance. For the image of any object, or part of an object, diminishes as its distance increases.

The sixth and last method by which we judge of the distance of objects is, that the eye does not represent to our mind one object alone, but at the same time all those that are placed betwixt us and the principal object, whose distance we are considering; and the more this distance is divided into separate and distinct parts, the greater it appears to be. For this reason, distances upon uneven surfaces appear less than upon a plane: for the inequalities of the surfaces, such as hills, and holes, and rivers, that lie low and out of sight, either do not appear, or hinder the parts that lie behind them from appearing; and so the whole apparent distance is diminished by the parts that do not appear in it. This is the reason that the banks of a river appear contiguous to a distant eye, when the river is low and not seen.

190 Several fallacies of vision explained.

Dr Porterfield very well explains several fallacies in vision which depend upon our mistaking the distances of objects. Of this kind, he says, is the appearance of parallel lines, and long vistas consisting of parallel rows of trees; for they seem to converge more and more as they are farther extended from the eye. The reason of this, he says, is because the apparent magnitudes of their perpendicular intervals are perpetually diminishing, while, at the same time, we mistake their distance. Hence we may see why, when two parallel rows of trees stand upon an ascent, whereby the more remote parts appear farther off than they really are, because the line that measures the length of the vistas now appears under a greater angle than when it was horizontal, the trees, in such a case, will seem to converge less, and sometimes, instead of converging, they will be thought to diverge.

For the same reason that a long vista appears to converge more and more the farther it is extended from the eye, the remoter parts of a horizontal walk or a long floor will appear to ascend gradually; and objects placed upon it, the more remote they are the higher they will appear, till the last be seen on a level with the eye; whereas the ceiling of a long gallery appears to descend towards a horizontal line, drawn from the eye of the spectator. For this reason, also, the surface of the sea, seen from an eminence, seems to rise higher and higher the farther we look; and the upper parts of high buildings seem to stoop, or incline forwards over the eye below, because they seem to approach towards a vertical line proceeding from the spectator's eye; so that statues on the top of such buildings, in order to appear upright, must recline, or bend backwards.

Dr Porterfield also shows the reason why a windmill, seen from a great distance, is sometimes imagined to move the contrary way from what it really does, by our taking the nearer end of the sail for the more remote. The uncertainty we sometimes find in the course of the motion of a branch of lighted candles, turned round at a distance, is owing, he says, to the same cause; as also our sometimes mistaking a convex for a concave surface, more especially in viewing seals and impressions with a convex glass or a double microscope; and lastly, that, upon coming in a dark night into a street, in which there is but one row of lamps, we often mistake the side of the street they are on.

Far more light was thrown upon this curious subject by M. Bouguer.

The proper method of drawing the appearance of two

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two rows of trees that shall appear parallel to the eye, is a problem which has exercised the ingenuity of several philosophers and mathematicians. That the apparent magnitude of objects decreases with the angle under which they are seen, has always been acknowledged. It is also acknowledged, that it is only by custom and experience that we learn to form a judgement both of magnitudes and distances. But in the application of these maxims to the above-mentioned problem, all persons, before M. Bouguer, made use of the real distance instead of the apparent one; by which only the mind can form its judgment. And it is manifest, that, if any circumstances contribute to make the distance appear otherwise than it is in reality, the apparent magnitude of the object will be affected by it; for the same reason, that, if the magnitude be misapprehended, the idea of the distance will vary.

191 Great light thrown upon the subject by M. Bouguer.

For want of attending to this distinction, Tacquet pretended to demonstrate, that nothing can give the idea of two parallel lines (rows of trees for instance) to an eye situated at one of their extremities, but two hyperbolical curves, turned the contrary way; and M. Varignon maintained, that in order to make a vista appear of the same width, it must be made narrow, instead of wider, as it recedes from the eye.

M. Bouguer observes, that very great distances, and those that are considerably less than they, make nearly the same impression upon the eye. We, therefore, always imagine great distances to be less than they are; and for this reason the ground plan of a long vista always appears to rise. The visual rays come in a determinate direction; but as we imagine that they terminate sooner than they do, we necessarily conceive that the place from which they issue is elevated. Every large plane, therefore, as AB, viewed by an eye at O, will seem to lie in such a direction as A*b*; and consequently lines, in order to appear truly parallel on the plane AB, must be drawn so as that they would appear parallel on the plane A *d*, and be from thence projected to the plane AB.

Plate CCCLXXXIV. fig. 2.

To determine the inclination of the apparent ground-plan A*d* to the true ground plan AB, our ingenious author directs us to draw upon a piece of level ground two straight lines of a sufficient length (for which purpose lines fastened to small sticks are very convenient), making an angle of 3 or 4 degrees with one another. Then a person, placing himself within the angle, with his back towards the angular point, must walk backwards and forwards till he can fancy the lines to be parallel. In this situation, a line drawn from the point of the angle through the place of his eye, will contain the same angle with the true ground-plan which this does with the apparent one.

M. Bouguer then shows other more geometrical methods of determining this inclination; and says; that by these means he has often found it to be 4 or 5 degrees, though sometimes only 2 or $2\frac{1}{2}$ degrees. The determination of this angle, he observes, is variable; depending upon the manner in which the ground is illuminated and the intensity of the light. The colour of the soil is also not without its influence, as well as the particular conformation of the eye, by which it is more or less affected by the same degree of light, and also the part of the eye on which the object is painted. When, by a slight motion of his head, he contrived, that certain parts of the soil, the image of which fell towards the bottom of his eye, should fall towards the top of the retina, he always thought that this apparent inclination became a little greater.

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But what is very remarkable, is, that if he look towards a rising ground, the difference between the apparent ground-plan and the true one will be much more considerable, so that they will sometimes make an angle of 25 or 30 degrees. Of this he had made frequent observations. Mountains, he says, begin to be inaccessible when their sides make an angle from 35 or 37 degrees with the horizon, as then it is not possible to climb them but by means of stones or shrubs, to serve as steps to fix the feet on. In these cases, both he and his companions always agreed that the apparent inclination of the side of the mountain was 60 or 70 degrees.

Plate CCCLXXXIV. fig 3.

These deceptions are represented in fig. 3. in which, when the ground-plan AM, or AN, is much inclined, the apparent ground-plan A*m*, or A*n*, makes a very large angle with it. On the contrary, if the ground dips below the level, the inclination of the apparent to the true ground-plan diminishes, till, at a certain degree of the slope, it becomes nothing at all; the two plans AP and A*p* being the same, so that parallel lines drawn upon them would always appear so. If the inclination below the horizon is carried beyond the situation AP, the error will increase; and what is very remarkable, it will be on the contrary side; the apparent plan A*r* being always below the true plan AR, so that if a person would draw upon the plan AR lines that shall appear parallel to the eye, they must be drawn converging, and not diverging, as is usual on the level ground; because they must be the projections of two lines imagined to be parallel, on the plan A*r*, which is more inclined to the horizon than AR.

These remarks, he observes, are applicable to different planes exposed to the eye at the same time. For if BH, fig. 4. be the front of a building, at the distance of AB from the eye, it will be reduced in appearance to the distance A*b*; and the front of the building will be *b h*, rather inclined towards the spectator, unless the distance be inconsiderable.

Fig. 4.

After making a great number of observations upon this subject, our author concludes, that when a man stands upon a level plane, it does not seem to rise sensibly but at some distance from him. The apparent plane, therefore, has a curvature in it, at that distance, the form of which is not very easy to determine; so that a man standing upon a level plane, of infinite extent, will imagine that he stands in the centre of a bason. This is also, in some measure, the case with a person standing upon the level of the sea.

He concludes with observing, that there is no difficulty in drawing lines according to these rules, so as to have any given effect upon the eye, except when some parts of the prospect are very near the spectator, and others very distant from him, because, in this case, regard must be had to the conical or conoidal figure of a surface. A right line passing at a small distance from the observer, and below the level of his eye, in that case almost always appears sensibly curved at a certain distance from the eye; and almost all figures in this case are subject to some complicated optical alteration to which the rules of perspective have not as yet been extended. If a circle be drawn near our feet, and within that

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that part of the ground which appears level to us, it will always appear to be a circle, and at a very considerable distance it will appear an ellipse; but between these two situations, it will not appear to be either the one or the other, but will be like one of those ovals of Descartes, which is more curved on one of its sides than the other.

On these principles a parterre, which appears distorted when it is seen in a low situation, appears perfectly regular when it is viewed from a balcony or any other eminence. Still, however, the apparent irregularity takes place at a greater distance, while the part that is near the spectator is exempt from it. If

Fig. 5.

AB, fig. 5. be the ground-plan, and A *a* be a perpendicular, under the eye, the higher it is situated, at O, to the greater distance will T, the place at which the plane begins to have an apparent ascent along T *b*, be removed.

192 Visible motion of objects.

All the varieties that can occur with respect to the visible motion of objects, are thus succinctly summed up by Dr Porterfield under eleven heads.

1. An object moving very swiftly is not seen, unless it be very luminous. Thus a cannon ball is not seen if it is viewed transversely: but if it be viewed according to the line it describes, it may be seen, because its picture continues long on the same place of the retina; which, therefore, receives a more sensible impression from the object.

2. A live coal swung briskly round in a circle appears a continued circle of fire, because the impressions made on the retina by light, being of a vibrating, and consequently of a lasting nature, do not presently perish, but continue till the coal performs its whole circuit, and returns again to its former place.

3. If two objects, unequally distant from the eye, move with equal velocity, the more remote one will appear the slower; or, if their celerities be proportional to their distances, they will appear equally swift.

4. If two objects, unequally distant from the eye, move with unequal velocities in the same direction, their apparent velocities are in a ratio compounded of the direct ratio of their true velocities, and the reciprocal one of their distances from the eye.

5. A visible object moving with any velocity appears to be at rest, if the space described in the interval of one second be imperceptible at the distance of the eye. Hence it is that a near object moving very slowly, as the index of a clock, or a remote one very swiftly, as a planet, seems to be at rest.

6. An object moving with any degree of velocity will appear at rest, if the space it runs over in a second of time be to its distance from the eye as 1 to 1400.

7. The eye proceeding straight from one place to another, a lateral object, not too far off, whether on the right or left, will seem to move the contrary way.

8. The eye proceeding straight from one place to another, and being sensible of its motion, distant objects will seem to move the same way, and with the same velocity. Thus, to a person running eastwards, the moon on his right hand appears to move the same way, and with equal swiftness; for on account of its distance, its image contines fixed upon the same place of the retina, from whence we imagine that the object moves along with the eye.

9. If the eye and the object move both the same way, only the eye much swifter than the object, the last will appear to go backwards.

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10. If two or more objects move with the same velocity, and a third remain at rest, the moveable ones will appear fixed, and the quiescent one in motion the contrary way. Thus when the clouds move very swiftly, their parts seem to preserve their situation, and the moon to move the contrary way.

11. If the eye be moved with great velocity, lateral objects at rest appear to move the contrary way. Thus to a person sitting in a coach, and riding briskly through a wood, the trees seem to retire the contrary way; and to people in a ship, &c. the shores seem to recede.

193 Dr Porterfield's account of objects appearing to move to a giddy person when he and they are both at rest.

At the conclusion of these observations, Dr Porterfield endeavours to explain another phenomenon of motion, which, though common and well known, had not been explained in a satisfactory manner. It is this: If a person turns swiftly round, without changing his place, all objects about will seem to move round in a circle the contrary way; and this deception continues not only while the person himself moves round, but, which is more surprising, it also continues for some time after he ceases to move, when the eye, as well as the object, is at absolute rest.

The reason why objects appear to move round the contrary way, when the eye turns round, is not so difficult to explain: for though, properly speaking, motion is not seen, as not being in itself the immediate object of sight; yet by the sight we easily know when the image changes its place on the retina, and thence conclude that either the object, the eye, or both, are moved. But by the sight alone we can never determine how far this motion belongs to the object, how far to the eye, or how far to both. If we imagine the eye at rest, we ascribe the whole motion to the object, though it be truly at rest. If we imagine the object at rest, we ascribe the whole motion to the eye, though it belongs entirely to the object; and when the eye is in motion, though we are sensible of its motion, yet, if we do not imagine that it moves so swiftly as it really does, we ascribe only a part of the motion to the eye, and the rest of it we ascribe to the object, though it be actually at rest. This last, he says, is what happens in the present case, when the eye turns round; for though we are sensible of the motion of the eye, yet we do not apprehend that it moves so fast as it really does; and therefore the bodies about appear to move the contrary way, as is agreeable to experience.

But the great difficulty still remains, viz. Why, after the eye ceases to move, objects should, for some time, still appear to continue in motion, though their pictures on the retina be really at rest, and do not at all change their place. This, he imagined, proceeds from a mistake we are in with respect to the eye, which, though it be absolutely at rest, we nevertheless conceive as moving the contrary way to that in which it moved before; from which mistake, with respect to the motion of the eye, the objects at rest will appear to move the same way which the eye is imagined to move; and, consequently, will seem to continue their motion for some time after the eye is at rest.

194 Dr Wells accounts for this phenomenon.

This is ingenious, but perhaps not just. An account of this matter, which seems to us more satisfactory,

Apparent place, &c. of objects. tory, has been lately given to the public by Dr Wells. "Some of the older writers upon optics (says this ingenious philosopher) imagined the visive spirits to be contained in the head, as water is in a vessel; which, therefore, when once put in motion by the rotation of our bodies, must continue in it for some time after this has ceased; and to this real circular movement of the visive spirits, while the body is at rest, they attributed the apparent motions of objects in giddiness. Dechales saw the weakness of this hypothesis; and conjectured, that the phenomenon might be owing to a real movement of the eyes; but produced no fact in proof of his opinion. Dr Porterfield, on the contrary, supposed the difficulty of explaining it to consist in showing, why objects at rest appear in motion to an eye which is also at rest. The solution he offered of this representation of the phenomenon, is not only extremely ingenious, but is, I believe, the only probable one which can be given. It does not apply, however, to the fact which truly exists; for I shall immediately show, that the eye is not at rest as he imagined. The last author I know of who has touched upon this subject is Dr Darwin. His words are, 'When any one turns round rapidly on one foot till he becomes dizzy, and falls upon the ground, the spectra of the ambient objects continue to present themselves in rotation, or appear to librate, and he seems to behold them for some time in motion.' I do not indeed pretend to understand his opinion fully; but this much seems clear, that if such an apparent motion of the surrounding objects depends in any way upon their spectra, or the illusive representations of those objects, occasioned by their former impressions upon the retinas, no similar motion would be observed, were we to turn ourselves round with our eyes shut, and not to open them till we became giddy; for in this case, as the surrounding objects could not send their pictures to the retinas, there would consequently be no spectra to present themselves afterward in rotation. But whoever will make the experiment, will find, that objects about him appear to be equally in motion, when he has become giddy by turning himself round, whether this has been done with his eyes open or shut. I shall now venture to propose
195 my own opinion upon this subject.

Upon what data we judge visible objects to be in motion or at rest.

"If the eye be at rest, we judge an object to be in motion when its picture falls in succeeding times upon different parts of the retina; and if the eye be in motion, we judge an object to be at rest, as long as the change in the place of its picture upon the retina holds a certain correspondence with the change of the eye's position. Let us now suppose the eye to be in motion, while, from some disorder in the system of sensation, we are either without those feelings which indicate the various positions of the eye, or are not able to attend to them. It is evident, that in such a state of things an object at rest must appear to be in motion, since it sends in succeeding times its picture to different parts of the retina. And this seems to be what happens in giddiness. I was first led to think so from observing, that, during a slight fit of giddiness I was accidentally seized with, a coloured spot, occasioned by looking steadily at a luminous body, and upon which I happened at that moment to be making an experiment, was moved in a manner altogether independent of the positions I conceived my eyes to possess. To determine this point, I again produced the spot, by looking some time at the flame of a candle: then turning myself round till I became giddy, I suddenly discontinued this motion, and directed my eyes to the middle of a sheet of a paper, fixed upon the wall of my chamber. The spot now appeared upon the paper, but only for a moment; for it immediately after seemed to move to one side, and the paper to the other, notwithstanding I conceived the position of my eyes to be in the mean while unchanged. To go on 196

Curious experiments to ascertain this.

with the experiment, when the paper and spot had proceeded to a certain distance from each other, they suddenly came together again; and this separation and conjunction were alternately repeated a number of times, the limits of the separation gradually becoming less, till at length the paper and spot both appeared to be at rest, and the latter to be projected upon the middle of the former. I found also, upon repeating and varying the experiment a little, and when I had turned myself from left to right, the paper moved from right to left, and the spot consequently the contrary way; but that when I had turned from right to left, the paper would then move from left to right. These were the appearances observed while I stood erect. When I inclined, however, my head in such a manner as to bring the side of my face parallel to the horizon, the spot and paper would then move from each other, one upward and the other downward. But all these phenomena demonstrate, that there was a real motion in my eyes at the time I imagined them to be at rest; for the apparent situation of the spot, with respect to the paper, could not possibly have been altered, without a real change of the position of those organs. To have the same thing proved in another way, I desired a person to turn quickly round, till he became very giddy; then to stop himself, and look steadfastly at me. He did so, and I could plainly see, that although he thought his eyes were fixed, they were in reality moving in their sockets, first toward one side and then toward the other." 197

A remarkable deception explained by M. le Cat. Plate ccclxxxiv. fig. 6.

M. Le Cat well explains a remarkable deception, by which a person shall imagine an object to be on the opposite side of a board, when it is not so, and also inverted and magnified. It is illustrated by fig. 6. in which D represents the eye, and CB a large black board, pierced with a small hole. E is a large white board, placed beyond it, and strongly illuminated; and *d* a pin, or other small object, held betwixt the eye and the first board. In these circumstances, the pin shall be imagined to be at F, on the other side of the board, where it will appear inverted and magnified; because what is in fact perceived, is the shadow of the pin upon the retina; and the light that is stopped by the upper part of the pin coming from the lower part of the enlightened board, and that which is stopped by the lower part coming from the upper part of the board, the shadow must necessarily be inverted with respect to the object. This is nothing more than Mr Grey's experiment, in which he saw an inverted image of the pin, and which we have already noticed.

There is a curious phenomena relating to vision, which some persons have ascribed to the inflection of light, but which Mr Melville explains in a very different and very simple manner. 198

A curious phenomenon explained by Mr Melville.

When any opaque body is held at the distance of three or four inches from the eye, so that a part of some more distant luminous object, such as the window, or the flame of a candle, may be seen by rays passing near its edge,

Apparent place, &c. of objects.

edge, if another opaque body, nearer to the eye, be brought across from the opposite side, the edge of the first body will seem to swell outwards, and meet the latter; and in doing so will intercept a portion of the luminous object that was seen before.

Fig. 7. This appearance he explains in the following manner; Let AB represent the luminous object to which the sight is directed, CD the more distant opaque body, GH the nearer, and EF the diameter of the pupil. Join ED, FD, EG, FG, and produce them till they meet AB in K, N, M, and L. It is plain that the parts AN, MB, of the luminous object cannot be seen. But taking any point a between N and K, and drawing a D d, since the portion d F of the pupil is filled with light flowing from that point, it must be visible. Any point b, between a and K, must fill f F, a greater portion of the pupil, and therefore must appear brighter. Again, Any point c between b and K, must appear brighter than b, because it fills a greater portion g F with light. The point K itself, and every other point in the space KL, must appear very luminous, since they send entire pencils of rays EKF, ELF, to the eye; and the visible brightness of every point from L towards M, must decrease gradually, as from K to N, that is, the spaces KN, LM, will appear as dim shadowy borders, or fringes, adjacent to the edges of the opaque bodies.

When the edge G is brought to touch the right line KF, the penumbras unite; and as soon as it reaches NDF, the above phenomenon begins; for it cannot pass that right line without meeting some line a D d, drawn from a point between N and K, and, by intercepting all the rays that fall upon the pupil, render it invisible. In advancing gradually to the line KDE, it will meet other lines b D f, c D g, &c. and therefore render the points b, c, &c. from N to K, successively invisible; and therefore the edge of the fixed opaque body CD must seem to swell outwards, and cover the whole space NK; while GH, by its motion, covers MK. When GH is placed at a greater distance from the eye, CD continuing fixed, the space OP to be passed over in order to intercept NK is less: and therefore, with an equal motion of GH, the apparent swelling of CD must be quicker; which is found true by experience.

If ML represent a luminous object, and REFQ any plane exposed to its light, the space FQ will be entirely shaded from the rays, and the space FE will be occupied by a penumbra, gradually darker, from E to F. Let now GH continue fixed, and CD move parallel to the plane EF; and as soon as it passes the line LF, it is evident that the shadow QF will seem to swell outwards; and when CD reaches ME, so as to cover with its shadow the space RE, QF, by its extension, will cover FE. This is found to hold true likewise by experiment.

Sect. X. *On Aberration of Figure or Sphericity.*

199 Theory of aberration.

The great practical use of the science of optics is to aid human sight; but it has been repeatedly observed during the progress of this article, that in constructing dioptrical instruments for this purpose, great difficulties arise from the aberration of light. It has been shown how to determine the concourse of any refracted ray PF' with the ray RVCF', which passes through the centre C, and therefore falls perpendicularly on the

Plate cclxxviii Figs. 5, 6, &c.

Of Aberration.

spherical surface at the vertex V, and suffers no refraction. This is the conjugate focus to R for the two rays RP, RV, and for another ray flowing from R and falling on the surface at an equal distance on the opposite side to P. In short, it is the conjugate focus for all the rays flowing from R, and falling on the spherical surface in the circumference of a circle described by the revolution of the point P round the axis RVCF; that is, of all the rays which occupy the conical surface described by the revolution of RP, and the refracted rays occupy the conical surface produced by the revolution of PF'.

But no other rays flowing from R are collected at F'; for it appeared in the demonstration of that proposition, that rays incident at a greater distance from the axis RC were collected at a point between C and F'; and then the rays which are incident on the whole arch PC, or the spherical surface generated by its revolution round RC, although they all cross the axis RC, are diffused over a certain portion of it, by what has been called the aberration of figure. It is called also (but improperly) the aberration from the geometrical focus, by which is meant the focus of an infinitely slender pencil of rays, of which the middle ray (or axis of the pencil) occupies the lens RC, and suffers no refraction. But there is no such focus. But if we make mRV—nRC : mRV=VC : VF, the point F is called the geometrical focus, and is the remotest limit from C of all the foci (equally geometrical) of rays flowing from R. The other limit is easily determined by constructing the problem for the extreme point of the given arch.

It is evident from the construction, that while the point of incidence P is near to V, the line CK increases but very little, and therefore CF diminishes little, and the refracted rays are but little diffused from F; and therefore they are much denser in its vicinity than any other point of the axis. It will soon be evident that they are incomparably denser. It is on this account that the point F has been called the conjugate focus to R, and the geometrical focus, and the diffusion has been called *aberration.* A geometrical point R is thus represented by a very small circle at F, and F has drawn the chief attention. And as, in the performance of optical instruments, it is necessary that this extended representation of a mathematical point R be very small, that it may not sensibly interfere with the representations of the points adjacent to R, and thus cause indistinct vision, a limit is thus set to the extent of the refracting surface which must be employed to produce this representation. But this evidently diminishes the quantity of light, and renders the vision *obscure* though distinct. Artists have therefore endeavoured to execute refracting surfaces of forms not spherical, which collect accurately to one point the light issuing from another, and the mathematicians have furnished them with forms having this property: but their attempts have been fruitless. Spherical surfaces are the only ones which can be executed with accuracy. All are done by grinding the refracting substance in a mould of proper materials. When this is spherical, the two work themselves, with moderate attention, into an exact sphere; because if any part is more prominent than another, it is ground away, and the whole gets of necessity one curvature. And it is astonishing to what degree of accuracy this is done. An error of the millionth part of an inch would totally destroy

stroy the figure of a mirror of an inch focal distance, so as to make it useless for the coarsest instrument. Therefore all attempts to make other figures are given up. Indeed other reasons make them worse than spherical, even when accurately executed. They would not collect to accurate focuses the rays of oblique pencils.

It is evident from these observations, that the theory of aberrations is absolutely necessary for the successful construction of optical instruments; and it must be acceptable to the reader to have a short account of it in this place. Enough shall be said here to show the *general* nature and effects of it in optical instruments, and in some of the more curious phenomena of nature. Under the article TELESCOPE the subject will be resumed, in such a manner as to enable the reader who possesses a very moderate share of mathematical knowledge, not only to understand how aberrations are increased and diminished, but also how, by a proper employment of contrary aberrations, their hurtful effects may be *almost entirely* removed in all important cases. And the manner in which the subject shall be treated in the present general sketch, will have the advantage of pointing out at the same time the maxims of construction of the greatest part of optical instruments, which generally produce their effects by means of pencils of rays which are either out of the axis altogether, or are oblique to it; cases which are seldom considered in elementary treatises of optics.

Plate CCCLXXXIV. fig. 1.

Let PV π be a spherical surface of a refracting substance (glass for instance), of which C is the centre, and let an indefinitely slender pencil of rays AP $a\,p$ be incident on it, in a direction parallel to a ray CV passing through the centre. It is required to determine the focus f of this pencil.

200 How to remedy the evils of aberration.

Let AP be refracted into PF. Draw CI, CR the sines of incidence and refraction, and CP the radius. Draw RB perpendicular to CP, and Bf parallel to AP or CV. I say, first, f is the focus of the indefinitely slender pencil, or, more accurately speaking, f is the remotest limit from P of the concourse of rays with PF' refracted by points lying without the arch VP, or the nearest limit for rays incident between V and P.

Draw the radius C$p\,c'$, the line $p\,f$; and draw $p\,g$ parallel to Pf, and Po perpendicular to Pf. It is evident, that if f be the focus, $c'\,p\,f$ is the angle of refraction corresponding to the angle of incidence $a\,p$ C, as C'Pf is the angle corresponding to APC. Also PCp is the increment of the angle of incidence, and the angle $c'\,p\,g$ is equal to the sum of the angle C'Pf and C'C c, and the angle $g\,p\,f$ is equal to the angle $p\,f$P. Therefore $c'pf$=C'Pf+P, Cp+Pfp. Therefore PCp+P$f\,p$ is the corresponding increment of the angle of refraction. Also, because RPo=CPp (being right angles) the angles p P o=RPC, and Po : Pp= PR : PC.

Therefore by a preceding Lemma in this article, we have PCp+Pfp : PCp=tan. ref. : tan. incid.= T, R : T, I; and Pfp : PCp=T, R—T, I : T, I, =diff. : T, I; but Pfp : PC $p=\frac{\mathrm{P}o}{\mathrm{P}f}:\frac{\mathrm{P}p}{\mathrm{P}c}=\frac{\mathrm{PR}}{\mathrm{P}f}:\frac{\mathrm{PC}}{\mathrm{PC}}$, =PR : P$f$,=DR : DB (because DB is parallel to Bf by construction)=tan.CPR—tan.CPI : tan.CPI. Now CPI is the angle of incidence; and therefore CPR is the angle properly corresponding to it as an angle of refraction, and the point f is properly determined.

Hence the following rule. *As the difference of the tangents of incidence and refraction is to the tangent of incidence, so is the radius of the surface multiplied by the cosine of refraction to the distance of the focus of an infinitely slender pencil of parallel incident rays.*

N. B. We here consider the cosine of refraction as a number. This was first done by the celebrated Euler, and is one of the greatest improvements in mathematics which this century can boast of. The sines, tangents, secants, &c. are considered as fractional numbers, of which the radius is unity. Thus CP$\times$sin. 30°, is the same thing with $\frac{1}{2}$CP, or $\frac{\mathrm{CP}}{2}$. And in like manner, CB, drawn perpendicular to the axis $\times$ sin. $19^{\circ}\,28'\,16''\,32'''$, is the same thing with $\frac{1}{3}$ of CB. Also $\frac{\mathrm{CB}}{\mathrm{cos.}\ 60^{\circ}}$ is the same thing with twice CB, &c.

In this manner, BE=BC$\times$sin. BCE, and also BE =CE$\times$tan. BCE, and CB=CE$\times$sec. BCE, &c. &c. This manner of considering the lines which occur in geometrical constructions is of immense use in all parts of mixed mathematics; and nowhere more remarkably than in optics, the most beautiful example of them. Of this an important instance shall now be given.

COR. 1. The distance fG of this lateral focus from the axis CV (that is, from the line drawn through the centre parallel to the incident light) is proportional to the cube of the semi-aperture PH of the spherical surface.

For fG=BE. Now BE=CB$\times$sin. BCE, =CB $\times$sin. CPA; and CB=RC$\times$cos. RCB, =RC$\times$sin. CPR, and RC=CP$\times$sin. CPR: Therefore BE=PC $\times$sin.^{2} CPR$\times$sin. PCA, =PC$\times$sin.^{2} refr. $\times$sin. incid. but sin.^{2} refr. $=\frac{m^2}{n^2}$ sin.^{2} incid. Therefore, finally, BE, or fG=PC$\times\frac{m^2}{n^2}\times$sin.^{3} incid.: But PC, sin. incid. is evidently PH the semi-aperture; therefore the proposition is manifest.

COR. 2. Now let this slender pencil of rays be incident at the vertex V. The focus will now be a point F in the axis, determined by making CV : CF=m—n : m. Let the incident pencil gradually recede from the axis CF, still, however, keeping parallel to it. The focus f will always be found in a curve line DC'F, so constituted that the ordinate G will be as the cube of the line PH, perpendicular to the axis intercepted between the axis and that point of the surface which is cut by a tangent to the curve in f.

All the refracted rays will be tangents to this curve, and the adjacent rays will cross each other in these lateral foci f; and will therefore be incomparably more dense along the curve than anywhere within its area. This is finely illustrated by receiving on white paper the light of the sun refracted through a globe or cylinder of glass filled with water. If the paper is held parallel to the axis of the cylinder, and close to it, the illuminated part will be bounded by two very bright parallel lines, where it is cut by the curve; and these lines will gradually approach each other as the paper is withdrawn from the vessel, till they coalesce into one very bright

Of Aberration.

bright line at F, or near it. If the paper be held with its end touching the vessel, and its plane nearly perpendicular to the axis, the whole progress of the curve will be distinctly seen.

As such globes were used for burning glasses, the point of greatest condensation (which is very near but not exactly in F) was called the *focus*. When these curves were observed by Mr Tchirnhauss, he called them *caustics;* and those formed by refraction he called *diacaustics*, to distinguish them from the *catacaustics* formed by reflection.

It is somewhat surprising, that these curves have been so little studied since the time of Tchirnhauss. The doctrine of aberrations has indeed been considered in a manner independent on their properties. But whoever considers the progress of rays in the eye-piece of optical instruments, will see that the knowledge of the properties of diacaustic curves determines directly, and almost accurately, the foci and images that are formed there. For, let the object-glass of a telescope or microscope be of any dimensions, the pencils incident on the eye-glasses are almost all of this evanescent bulk. These advantages will be shown in their proper places: and we proceed at present to extend our knowledge of aberrations in general, first considering the aberrations of parallel incident rays.

Abiding by the instance represented by the figure, it is evident that the caustic will touch the surface in a point ϕ, so situated that $c\phi : \phi\chi = m : n$. The refracted ray $\phi\,\Phi$ will touch the surface, and will cross the axis in Φ, the nearest limit of diffusion along the axis. If the surface is of smaller extent, as PV, the caustic begins at f, when the extreme refracted ray Pf touches the caustic, and crosses the axis in F', and the opposite branch of the caustic in K. If there be drawn an ordinate KO k to the caustic, it is evident that the whole light incident on the surface PVπ passes through the circle whose diameter is K k, and that the circle is the smallest space which receives *all* the refracted light.

201 How light is distributed over the smallest circle of diffusion.

It is of great importance to consider the manner in which the light is distributed over the surface of this circle of smallest diffusion: for this is the representation of one point of the infinitely distant radiant object. Each point of a planet, for instance, is represented by this little circle; and as the circles representing the different adjacent points must interfere with each other, an indistinctness must arise similar to what is observed when we view an object through a pair of spectacles which do not fit the eye. The indistinctness must be in proportion to the number of points whose circles of diffusion interfere; that is, to the area of these circles, provided that the light is uniformly diffused over them: but if it be very rare at the circumference, the impression made by the circles belonging to the adjacent points must be less sensible. Accordingly, Sir Isaac Newton, supposing it incomparably rarer at the circumference than towards the centre, affirms that the indistinctness of telescopes, arising from the spherical figure of the object-glass, was some thousand times less than that arising from the unequal refrangibility of light; and, therefore, that the attempts to improve them by diminishing or removing this aberration were needless, while the indistinctness from unequal refrangibility remained. It is surprising, that a philosopher so eminent for sagacity and for mathematical knowledge should have made such a mistake, and unfortunate that the authority of his great name hindered others from examining the matter, trusting to his assertion that the light was so rare at the border of this circle. His mistake is surprising, because the very nature of a caustic should have showed him that the light was infinitely dense at the borders of the circle of smallest diffusion. The first person who detected this oversight of the British philosopher was the Abbé Boscovich, who, in a dissertation published at Vienna in 1767, showed, by a very beautiful analysis, that the distribution was extremely different from what Newton had asserted, and that the superior indistinctness arising from unequal refrangibility was incomparably less than he had said. We shall attempt to make this delicate and interesting matter conceived by those who have but small mathematical preparation.

Plate CCCLXXXVI. fig. 2.

Let the curve DVZCI $c\,z\,v\,d$ be the caustic (magnified), EI its axis, I the focus of central rays, B the focus of extreme rays, and IB the line containing the foci of all the intermediate rays, and CO c the diameter of the circle of smallest diffusion.

It is plain, that from the centre O there can be drawn two rays OV, O v, touching the caustic in V, v. Therefore the point O will receive the ray EO, which passes through the vertex of the refracting surface, and all the rays which are incident on the circumference of a circle described on the refracting surface by the extremity of the ray OV, or Ov. The density of the light at O will therefore be indefinitely great.

From the point C there can be drawn two rays; one of them CX touching the caustic in C, and the other C, touching it at d on the opposite side. The rays which touch the caustic in the immediate vicinity of C y, both in the arch CV and the arch CI will cut OC in points indefinitely near to each other; because their distance from each other in the line OC will be to their uniform distance on the refracting surface as the distance between their points of contact with the caustic to the distance of these points from the refracting surface. Here therefore at C the density of the light will also be indefinitely great.

From any point H, lying between O and C, may be drawn three rays. One of them LHT, P, touching the arch CD of the caustic in T, cutting the refracting surface in P, and the axis in L: another t Hp, touching the arch CI of the caustic in t. The third is H $\tau\pi$, touching the arch $c\,d$ of the opposite branch of the caustic in τ.

It will greatly assist our conception of this subject, if we consider a ray of light from the refracting surface as a thread attached at I of this figure, or at F of fig. 1. and gradually unlapped from the caustic DVCI on one side, and then lapped on the opposite branch I $c\,v\,d$; and attend to the point of its intersection with the diameter c OC of the circle of smallest diffusion. Fig. 1.

Therefore, 1. Let the ray be first supposed to pass through the refracting surface at F, the right hand extremity of the aperture. The thread is then folded up on the whole right hand branch ICVD of the caustic; and if the straight part of it FD be produced, it will cut the diameter of the circle of smallest diffusion in the opposite extremity c. Or suppose a ruler in place of the thread, applied to the caustic at D and to the refracting surface at F, the part of it Dc, which

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which is detached from the caustic, cuts CO c in the point c. 2. Now suppose the ruler to revolve gradually, its extremity moving across the arch FAf of the refracting surface while the edge is applied to the caustic; the point of contact with the caustic will shift gradually down the branch DV of the caustic, while its edge passes across the line cC; and when the point of contact arrives at V, the extremity will be at Y on the refracting surface, and the intersection of the edge will be at O. 3. Continuing the motion, the point of contact shifts from V to Z, the extremity from Y to Q', and the intersection from O to Q, so that $OQ^2 = \frac{OC^2}{2}$, as will presently appear. 4. After this, the point of contact will shift from Z to C, the extremity from Q' to X, half way from F to A, as will soon be shown, and the intersection from Q to C. 5. The point of contact will now shift from C down to I, the extremity will pass from X to A, and the intersection will go back from C to O. 6. The ruler must now be applied to the other branch of the caustic I c z v d, and the point of contact will ascend from I to c, the extremity will pass from A to x, half way to f from A, and the intersection from O to c. 7. The point of contact will ascend from C to z, the extremity passes from x to q', and the intersection from C to q, $O q^2$ being $= \frac{O c^2}{2}$. 8. While the contact of the ruler and caustic shifts from z to v, the extremity shifts from q' to y, and the intersection from q to O. 9. The contact rises from v to d, the extremity passes from y to f, and the intersection from O to C; and then the motion across the refracting surface is completed, the point of contact shifting down from D to I along the branch DVZCI, and then ascending along the other branch I c z v d, while the intersection passes from c to C, back again from C to c, and then back again from c to C, where it ends, having thrice passed through every intermediate point of cC.

202 Density of light.

We may form a notion of the density of the light in any point H, by supposing the incident light of uniform density at the refracting surface, and attending to the constipation of the rays in the circle of smallest diffusion. Their vicinity may be estimated both in the direction of the radii OH, and in the direction of the circumference described by its extremity H, during its revolution round the axis; and the density must be conceived as proportional to the *number* of originally equidistant rays, which are collected into a spot of given area. These have been collected from a corresponding spot or area of the refracting surface; and as the number of rays is the same in both, the density at H will be to the density of the refracting surface, as the area occupied of the refracting surface, to the corresponding area at H. The vicinity of the rays in the direction of the radius depends on the proportion between PT and TH. For the ray adjacent to PTH may be supposed to cross it at the point of contact T; and therefore the uniform distance between them at the surface of that medium is to the distance between the same rays at H as the distance of T from the refracting surface to its distance from H. Therefore the number of rays which occupy a tenth of an inch, for example, of the radius AP, is to the number which would occupy a tenth of an inch at H as TH to TP; and the radial density at P is to the radial density at H, also as TH to TP. In the next place, The circumferential density at P is to that at H as the radius AP to the radius OH. For supposing the figure to turn round its axis AI, the point P of the refracting surface will describe a circumference whose radius is AP, and H will describe a circumference whose radius is OH; and the whole rays which pass through the first circumference pass also through the last, and therefore their circumferential densities will be in the inverse proportion of the spaces into which they are collected. Now the radius AP is to the radius OH as AL to OL; and circumferences have the same proportion with their radii. Therefore the circumferential density at P is to that in H as AL to OL inversely; and it was found that the radial density was as AN to ON inversely, being as TH to TP, which are very nearly in this ratio. Therefore the absolute density (or number of rays collected in a given space) at P will be to that at H, in the ratio compounded of these ratios; that is, in the ratio of ON$\times$OL to AN$\times$AL. But as NL bears but a very small ratio to AN or AL, AN$\times$AL may be taken as equal to AO^2 without any sensible error. It never differs from it in telescopes 100th part, and is generally incomparably smaller. Therefore the density at H may be considered as proportional to ON$\times$OL inversely. And it will afterwards appear that NS is $= 3\,o$L. Therefore the density at H is inversely as ON$\times$NS.

Now describe a circle on the diameter OS, and draw NTφ cutting the circumference $N\varphi^2 = ON \times NS$, and the density at H is as $N\varphi^2$ inversely. This gives us a very easy estimation of the density, viz. draw a line from the point of contact of the ray which touches the part VC of the caustic, and the density is in the inverse subduplicate ratio of the part of this line intercepted between the axis and the circumference SφO. It will afterwards appear that the density corresponding to this ray is one half of the density corresponding to all the three: or a better expression will be had for the density at H by drawing R β perpendicular to R φ, and β o perpendicular to φ β, making φ R in o; then φo is as $\frac{1}{\varphi N^2}$, or is proportional to the density, as is evident.

When H is at O, N is at S, and φo is infinite. As H moves from O, N descends, and φo diminishes, till H comes to Q, and T to z, and φ to ζ, and o to R. When H moves from Q towards C, T descends below z, φo again increases, till it is again infinite, when H is at C, T at C, and N at O.

Thus it appears, without any minute consideration, that the light has a density indefinitely great in the centre O; that the density decreases to a minimum in some intermediate point Q, and then increases again to infinity at the margin C. Hence it follows, that the indistinctness arising from the spherical figure of the refracting surfaces is incomparably greater than Newton supposed; and that the valuable discovery of Mr Dollond of achromatic lenses, must have failed of answering his fond expectations, if his very method of producing them had not, at the same time, enabled him to remove that other indistinctness by employing contrary aberrations. And now, since the discovery by Dr Blair of substances which disperse the different colours in the same proportions, but very different degrees,

Of Aberration.

grees, has enabled us to employ much larger portions of the sphere than Mr Dollond could introduce into his object-glasses, it becomes absolutely necessary to study this matter completely, in order to discover and ascertain the amount of the errors which perhaps unavoidably remain.

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Contrary aberrations correct each other.

This slight sketch of the most simple case of aberration, namely, when the incident rays are parallel, will serve to give a general notion of the subject; and the reader can now see how contrary aberrations may be employed in order to form an ultimate image which shall be as distinct as possible. For let it be proposed to converge parallel rays accurately to the focus F, by the refraction of spherical surfaces of which V is the vertex. Let PV be a convex lens of such a form, that rays flowing from F, and passing through it immediately round the vertex V, are collected to the conjugate focus R, while the extreme ray FP, incident on the margin of the lens P, is converged to *r*, nearer to V, having the longitudinal aberration R *r*. Let *p* V be a plano-concave lens, of such sphericity that a ray A *p*, parallel to the axis CV, and incident on the point *p*, as far from its vertex V as P in the other lens is from its vertex, is dispersed from *r*, the distance ρ V being equal to r V, while the central rays are dispersed from P, as far from V as R is from V. It is evident, that if these lenses be joined as in fig. 4. a ray A'*p*, parallel to the common axis CV, will be collected at the distance VF equal to VF in the fig. 4. and that rays passing through both lenses in the neighbourhood of the axis will be collected at the same point F.

Plate CCLXXXVI. fig. 3.

This compound lens is said to be without spherical aberration; and it is true that the central and the extreme rays are collected in the same point F: but the rays which fall on the lens between the centre and margin are a little diffused from F, and it is not possible to collect them all to one point. For in the rules for computing the aberration, quantities are neglected which do not preserve, in different apertures, the same ratio to the quantities retained. The diffusion is least when the aberration is corrected, not for the very extremity, but for a certain intermediate point (varying with the aperture, and having no known ratio to it); and when this is done, the compound lens is in its state of greatest perfection, and the remaining aberration is quite insensible. See TELESCOPE.

SECT. VI. *On the different Refrangibility of Light.*

As this property of light solves a great number of the phenomena which could not be understood by former opticians, we shall give an account of it nearly in the words of Sir Isaac Newton, who first discovered it; especially as his account is more full and perspicuous than those of succeeding writers.

Plate CCLXXXIII. fig. 1.

"In a dark chamber, at a round hole F, about one third of an inch broad, made in the shutter of a window, I placed a glass prism ABC, whereby the beam of the sun's light, SF, which came in at that hole, might be refracted upwards, toward the opposite wall of the chamber, and there form a coloured image of the sun, represented at PT. The axis of the prism was, in this and the following experiments, perpendicular to the incident rays. About this axis I turned the prism slowly, and saw the refracted or coloured image of the sun, first to descend, and then to ascend. Between the descent and ascent, when the image seemed stationary, I stopped the prism and fixed it in that posture.

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"Then I let the refracted light fall perpendicularly upon a sheet of white paper, MN, placed at the opposite wall of the chamber, and observed the figure and dimensions of the solar image, PT, formed on the paper by that light. This image was oblong, and not oval, but terminated by two rectilinear and parallel sides and two semicircular ends. On its sides it was bounded pretty distinctly; but on its ends very indistinctly, the light there vanishing by degrees. At the distance of $18\frac{1}{2}$ feet from the prism the breadth of the image was about $2\frac{1}{8}$ inches, but its length was about $10\frac{1}{4}$ inches, and the length of its rectilinear sides about 8 inches; and ACB, the refracting angle of the prism, by which so great a length was made, was 64 degrees. With a less angle the length of the image was less, the breadth remaining the same. It is farther to be observed, that the rays went on in straight lines from the prism to the image, and therefore at their going out of the prism had all that inclination to one another from which the length of the image proceeded. This image PT was coloured, and the more eminent colours lay in this order from the bottom at T to the top at P; red, orange, yellow, green, blue, indigo, violet; together with all their intermediate degrees in a continual succession perpetually varying."

204
Light consists of several sorts of coloured rays differently refrangible.

Our author concludes from this and other experiments, "that the light of the sun consists of a mixture of several sorts of coloured rays, some of which at equal incidences are more refracted than others, and therefore are called *more refrangible*. The red at T, being nearest to the place Y, where the rays of the sun would go directly if the prism was taken away, is the least refracted of all the range; and the orange, yellow, green, blue, indigo, and violet, are continually more and more refracted, as they are more and more diverted from the course of the direct light. For by mathematical reasoning he has proved, that when the prism is fixed in the posture above mentioned, so that the place of the image shall be the lowest possible, or at the limit between its descent and ascent, the figure of the image ought then to be round like the spot at Y, if all the rays that tended to it were equally refracted. Therefore, since it is found by experience that this image is not round, but about five times longer than broad, it follows, that all the rays are not equally refracted. This conclusion is farther confirmed by the following experiments.

Fig. 2.

"In the sunbeam SF, which was propagated into the room through the hole in the window-shutter EG, at the distance of some feet from the hole, I held the prism ABC in such a posture, that its axis might be perpendicular to that beam: then I looked through the prism upon the hole F, and turning the prism to and fro about its axis to make the image *p t* of the hole ascend and descend, when between its two contrary motions it seemed stationary, I stopped the prism; in this situation of the prism, viewing through it the said hole E, I observed the length of its refracted image *p t* to be many times greater than its breadth; and that the most refracted part thereof appeared violet at *p*; the least refracted, at *t*; and the middle parts indigo, blue, green,

yellow,

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yellow, and orange, in order. The same thing happened when I removed the prism out of the sun's light, and looked through it upon the hole shining by the light of the clouds beyond it. And yet if the refractions of all the rays were equal according to one certain proportion of the sines of incidence and refraction, as is vulgarly supposed, the refracted image ought to have appeared round, by the mathematical demonstration above mentioned. So then by these two experiments it appears, that in equal incidences there is a considerable inequality of refractions."

For the discovery of this fundamental property of light, which has unfolded the whole mystery of colours, we see our author was not only beholden to the experiments themselves, which many others had made before him, but also to his skill in geometry; which was absolutely necessary to determine what the figure of the refracted image ought to be upon the old principle of an equal refraction of all the rays: but having thus made the discovery, he contrived the following experiment to prove it at sight.

Plate cclxxxiii. fig. 3.

"In the middle of two thin boards, DE *de*, I made a round hole in each, at G and *g*, a third part of an inch in diameter; and in the window-shut a much larger hole being made, at F, to let into my darkened chamber a large beam of the sun's light, I placed a prism, ABC, behind the shut in that beam, to refract it towards the opposite wall; and close behind this prism I fixed one of the boards DE, in such a manner that the middle of the refracted light might pass through the hole made in it at G, and the rest be intercepted by the board. Then at the distance of about 12 feet from the first board, I fixed the other board, *de*, in such manner that the middle of the refracted light, which came through the hole in the first board, and fell upon the opposite wall, might pass through the hole *g* in this other board *de*, and the rest being intercepted by the board, might paint upon it the coloured spectrum of the sun. And close behind this board I fixed another prism *abc*, to refract the light which came through the hole *g*. Then I returned speedily to the first prism ABC, and by turning it slowly to and fro about its axis, I caused the image which fell upon the second board *de*, to move up and down upon that board, that all its parts might pass successively through the hole on that board, and fall upon the prism behind it. And in the mean time I noted the places, *M*, *N*, on the opposite wall, to which that light after its refraction in the second prism did pass; and by the difference of the places at *M* and *N*, I found that the light, which being most refracted in the first prism ABC, did go to the blue end of the image, was again more refracted by the second prism *abc*, than the light which went to the red end of that image. For when the lower part of the light which fell upon the second board *de*, was cast through the hole *g*, it went to a lower place M on the wall; and when the higher part of that light was cast through the same hole *g*, it went to a higher place N on the wall; and when any intermediate part of the light was cast through that hole, it went to some place in the wall between M and N. The unchanged position of the hole in the boards made the incidence of the rays upon the second prism to be the same in all cases. And yet in that common incidence some of the rays were more refracted and others less: and those were more refracted in this prism, which by a greater refraction in the first prism were more turned out of their way; and, therefore, for their constancy of being more refracted, are deservedly called *more refrangible*."

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205 Reflected light differently refrangible.

Sir Isaac shows also, by experiments made with convex glass, that lights, reflected from natural bodies, which differ in colour, differ also in refrangibility; and that they differ in the same manner as the rays of the sun do.

"The sun's light consists of rays differing in reflexibility, and those rays are more reflexible than others which are more refrangible. A prism, ABC, whose two angles, at its base BC, were equal to one another and half right ones, and the third at A a right one, I placed in a beam FM of the sun's light, let into a dark chamber through a hole F one third part of an inch broad. And turning the prism slowly about its axis until the light which went through one of its angles ACB, and was refracted by it to G and H, began to be reflected into the line MN by its base BC, at which till then it went out of the glass; I observed that those rays, as MH, which had suffered the greatest refraction, were sooner reflected than the rest. To make it evident that the rays which vanished at H were reflected into the beam MN, I made this beam pass through another prism VXY, and being refracted by it to fall afterwards upon a sheet of white paper *pt* placed at some distance behind it, and there by that refraction to paint the usual colours at *pt*. Then causing the first prism to be turned about its axis according to the order of the letters ABC, I observed, that when those rays MH, which in this prism had suffered the greatest refraction, and appeared blue and violet, began to be totally reflected, the blue and violet light on the paper which was most refracted in the second prism received a sensible increase at *p*, above that of the red and yellow at *t*: and afterwards, when the rest of the light, which was green, yellow, and red, began to be totally reflected and vanished at G, the light of those colours at *t*, on the paper *pt*, received as great an increase as the violet and blue had received before. Which puts it past dispute, that those rays became first of all totally reflected at the base BC, which before at equal incidences with the rest upon the base BC had suffered the greatest refraction. I do not here take any notice of any refractions made in the sides AC, AB, of the first prism, because the light enters almost perpendicularly at the first side, and goes out almost perpendicularly at the second; and therefore suffers none, or so little, that the angles of incidence at the base BC are not sensibly altered by it; especially if the angles of the prism at the base BC be each about 40 degrees. For the rays FM begin to be totally reflected when the angle CMF is about 50 degrees, and therefore they will then make a right angle of 90 degrees with AC.

Fig. 4.

"It appears also from experiments, that the beam of light MN, reflected by the base of the prism, being augmented first by the more refrangible rays and afterwards by the less refrangible, is composed of rays differently refrangible.

"The light whose rays are all alike refrangible, I call *simple*, *homogeneous*, and *similar*; and that whose rays are some more refrangible than others, I call *compound*, *heterogeneous*, and *dissimilar*. The former light I call *homogeneous*, not because I would affirm it so in all respects;

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spects; but because the rays which agree in refrangibility agree at least in all their other properties which I consider in the following discourse.

206 Colours simple or compound.

"The colours of homogeneous lights I call *primary, homogeneous*, and *simple*; and those of heterogeneous lights, *heterogeneous* and *compound*. For these are always compounded of homogeneous lights, as will appear in the following discourse.

"The homogeneous light and rays which appear red, or rather make objects appear so, I call *rubrific* or *red-making*; those which make objects appear yellow, green, blue, and violet, I call *yellow-making, blue-making, violet-making*; and so of the rest. And if at any time I speak of light and rays as coloured or endowed with colours, I would be understood to speak not philosophically and properly, but grossly, and according to such conceptions as vulgar people in seeing all these experiments would be apt to frame. For the rays, to speak properly, are not coloured. In them there is nothing else than a certain power and disposition to stir up a sensation of this or that colour. For as sound, in a bell or musical string or other sounding body, is nothing but a trembling motion, and in the air nothing but that motion propagated from the object, and in the sensorium it is a sense of that motion under the form of sound; so colours in the object are nothing but a disposition to reflect this or that sort of rays more copiously than the rest: in rays they are nothing but their dispositions to propagate this or that motion into the sensorium; and in the sensorium they are sensations of those motions under the forms of colours. See CHROMATICS.

207 Why the image of the sun, by heterogeneous rays passing through a prism, is oblong. Plate ccclxxxiii. fig. 5.

"By the mathematical proposition above mentioned, it is certain that the rays which are equally refrangible do fall upon a circle answering to the sun's apparent disk, which will also be proved by experiment by and by. Now let AG represent the circle which all the most refrangible rays, propagated from the whole disk of the sun, will illuminate and paint upon the opposite wall if they were alone; EL the circle, which all the least refrangible rays would in like manner illuminate if they were alone; BH, CI, DK, the circles which so many intermediate sorts would paint upon the wall, if they were singly propagated from the sun in successive order, the rest being intercepted; and conceive that there are other circles without number, which innumerable other intermediate sorts of rays would successively paint upon the wall, if the sun should successively emit every sort apart. And seeing the sun emits all these sorts at once, they must all together illuminate and paint innumerable equal circles; of all which, being according to their degrees of refrangibility placed in order in a continual series, that oblong spectrum PT is composed, which was described in the first experiment.

"Now if these circles, whilst their centres keep their distances and positions, could be made less in diameter, their interfering one with another, and consequently the mixture of the heterogeneous rays, would be proportionably diminished. Let the circles AG, BH, CI, &c. remain as before; and let *ag, bh, ci*, &c. be so many less circles lying in a like continual series, between two parallel right lines *ae* and *gl*, with the same distance between their centres, and illuminated with the same sorts of rays: that is, the circle *ag* with the same sort by which the corresponding circle AG was illuminated; and the rest of the circles *bh, ci, dk, cl*, respectively with the same sorts of rays by which the corresponding circles BH, CI, DK, EL, were illuminated. In the figure PT, composed of the great circles, three of those, AG, BH, CI, are so expanded into each other, that three sorts of rays, by which those circles are illuminated, together with innumerable other sorts of intermediate rays, are mixed at QR in the middle of the circle BH. And the like mixture happens throughout almost the whole length of the figure PT. But in the figure *pt*, composed of the less circles, the three less circles *ag, bh, ci*, which answer to those three greater, do not extend into one another; nor are there anywhere mingled so much as any two of the three sorts of rays by which those circles are illuminated, and which in the figure PT are all of them intermingled at QR. So then, if we would diminish the mixture of the rays, we are to diminish the diameters of the circles. Now these would be diminished if the sun's diameter, to which they answer, could be made less than it is, or (which comes to the same purpose), if without doors, at great distance from the prism towards the sun, some opaque body were placed with a round hole in the middle of it to intercept all the sun's light, except so much as coming from the middle of his body could pass through that hole to the prism. For so the circles AG, BH, and the rest, would not any longer answer to the whole disk of the sun, but only to that part of it which could be seen from the prism through that hole; that is, to the apparent magnitude of that hole viewed from the prism. But that these circles may answer more distinctly to that hole, a lens is to be placed by the prism to cast the image of the hole (that is, every one of the circles AG, BH, &c.) distinctly upon the paper at PT; after such a manner, as by a lens placed at a window the pictures of objects abroad are cast distinctly upon the paper within the room. If this be done, it will not be necessary to place that hole very far off, no not beyond the window. And therefore, instead of that hole, I used a hole in the window-shut as follows.

"In the sun's light let into my darkened chamber through a small round hole in my window-shut, at about 10 or 12 feet from the window, I placed a lens MN, Fig. 6. by which the image of the hole F might be distinctly cast upon a sheet of white paper placed at I. Then immediately after the lens I placed a prism ABC, by which the trajected light might be refracted either upwards or sidewise, and thereby the round image which the lens alone did cast upon the paper at I, might be drawn out into a long one with parallel sides, as represented at *pt*. This oblong image I let fall upon another at about the same distance from the prism as the image at I, moving the paper either towards the prism or from it, until I found the just distance where the rectilinear sides of the images *pt* became most distinct. For in this case the circular images of the hole, which compose that image, after the manner that the circles *ag, bh, ci*, &c. do the figure *pt*, were terminated most distinctly, and therefore extended into one another the least that they could, and by consequence the mixture of the heterogeneous rays was now the least of all. The circles *ag, bh, ci*, &c. which compose the image *pt*, are each equal to the circle at I; and therefore, by diminishing the hole F, or by removing the lens farther from it, may be diminished at pleasure, whilst their centres keep the same distances from each other. Thus, by diminishing the

the breadth of the image $p\,t$, the circle of heterogeneal rays that compose it may be separated from each other as much as you please. Yet instead of the circular hole F, it is better to substitute a hole shaped like a parallelogram, with its length parallel to the length of the prism. For if this hole be an inch or two long, and but a 10th or 20th part of an inch broad, or narrower, the light of the image $p\,t$ will be as simple as before, or simpler; and the image being much broader, is therefore fitter to have experiments tried in its light than before.

"Homogeneal light is refracted regularly without any dilatation, splitting, or shattering of the rays; and the confused vision of objects seen through refracting bodies by heterogeneous light, arises from the different refrangibility of several sorts of rays. This will appear by the experiments which will follow. In the middle of a black paper I made a round hole about a fifth or a sixth part of an inch in diameter. Upon this part I caused the spectrum of homogeneous light, described in the former article, so to fall that some part of the light might pass through the hole in the paper. This transmitted part of the light, I refracted with a prism placed behind the paper: and letting the refracted light fall perpendicularly upon a white paper, two or three feet distant from the prism, I found that the spectrum formed on the paper by this light was not oblong, as when it is made in the first experiment, by refracting the sun's compound light, but was, so far as I could judge by my eye, perfectly circular, the length being nowhere greater than the breadth; which shows that this light is refracted regularly without any dilatation of the rays, and is an ocular demonstration of the mathematical proposition mentioned above.

208 The image of the sun by simple and homogeneous light, circular.

"In the homogeneous light I placed a paper circle of a quarter of an inch in diameter: and in the sun's unrefracted, heterogeneous, white light, I placed another paper circle of the same bigness; and going from these papers to the distance of some feet, I viewed both circles through a prism. The circle illuminated by the sun's heterogeneous light appeared very oblong, as in the second experiment, the length being many times greater than the breadth. But the other circle, illuminated with homogeneous light appeared circular, and distinctly defined, as when it is viewed by the naked eye; which proves the whole proposition mentioned in the beginning of this article.

209 Vision more distinct in homogeneous than in heterogeneous light.

"In the homogeneous light I placed flies and such like minute objects, and viewing them through a prism I saw their parts as distinctly defined as if I had viewed them with the naked eye. The same objects placed in the sun's unrefracted heterogeneous light, which was white, I viewed also through a prism, and saw them most confusedly defined, so that I could not distinguish their smaller parts from one another. I placed also the letters of a small print one while in the homogeneous light, and then in the heterogeneous; and viewing them through a prism, they appeared in the latter case so confused and indistinct that I could not read them; but in the former, they appeared so distinct that I could read readily, and thought I saw them as distinct as when I viewed them with my naked eye: in both cases, I viewed the same objects through the same prism, at the same distance from me, and in the same situation. There was no difference but in the lights by which the objects were illuminated, and which in one case was simple, in the other compound; and therefore the distinct vision in the former case, and confused in the latter, could arise from nothing else than from that difference in the lights. Which proves the whole proposition.

"In these three experiments, it is farther very remarkable, that the colour of homogeneous light was never changed by the refractions. And as these colours were not changed by refractions, so neither were they by reflections. For all white, gray, red, yellow, green, blue, violet bodies, as paper, ashes, red lead, orpiment, indigo, bice, gold, silver, copper, grass, blue flowers, violets, bubbles of water tinged with various colours, peacock feathers, the tincture of lignum nephriticum, and such like, in red homogeneous light appeared totally red, in blue light totally blue, in green light totally green, and so of other colours. In the homogeneous light of any colour they all appeared totally of that same colour; with this only difference, that some of them reflected that light more strongly, others more faintly. I never yet found any body which by reflecting homogeneous light could sensibly change its colour.

"From all which it is manifest, that if the sun's light consisted of but one sort of rays, there would be but one colour in the world, nor would it be possible to produce any new colour by reflections and refractions; and by consequence, that the variety of colours depends upon the composition of light.

"The solar image $p\,t$, formed by the separated rays in the 6th experiment, did in the progress from its end p, on which the most refrangible rays fell, unto its end t, on which the least refrangible rays fell, appear tinged with this series of colours; violet, indigo, blue, green, yellow, orange, red, together with all their intermediate degrees in a continual succession perpetually varying; so that there appeared as many degrees of colours as there were sorts of rays differing in refrangibility. And since these colours could not be changed by refractions nor by reflections, it follows that all homogeneal light has its proper colour answering to its degree of refrangibility.

210 Every homogeneous ray is refracted according to one and the same rule.

"Every homogeneous ray considered apart is refracted according to one and the same rule; so that its sine of incidence is to its sine of refraction in a given ratio: that is, every different coloured ray has a different ratio belonging to it. This our author has proved by experiment, and by other experiments has determined by what numbers those given ratios are expressed. For instance, if an heterogeneous white ray of the sun emerges out of glass into air; or, which is the same thing, if rays of all colours be supposed to succeed one another in the same line AC, and AD their common sine of incidence in glass be divided into 50 equal parts, then EF and GH, the sines of refraction into air, of the least and most refrangible rays, will be 77 and 78 such parts respectively. And since every colour has several degrees, the sines of refraction of all the degrees of red will have all intermediate degrees of magnitude from 77 to $77\frac{1}{8}$, of all the degrees of orange from $77\frac{1}{8}$ to $77\frac{1}{5}$, of yellow from $77\frac{1}{5}$ to $77\frac{1}{3}$, of green from $77\frac{1}{3}$ to $77\frac{1}{2}$, of blue from $77\frac{1}{2}$ to $77\frac{2}{3}$, of indigo from $77\frac{2}{3}$ to $77\frac{7}{9}$, and of violet from $77\frac{7}{9}$ to 78." See CHROMATICS, SUPPLEMENT.

Plate CCCLXXXIII fig. 15.

PART

PART II. EXPLANATION OF OPTICAL PHENOMENA.

Sect. I. *Of the Rainbow.*

211 Knowledge of the nature of the rainbow a modern discovery.

The observations of the ancients, and the philosophers of the middle ages, concerning the rainbow, were such as could not have escaped the notice of the most illiterate husbandmen; and their various hypotheses deserve no notice. It is a considerable time, even after the dawn of true philosophy, before we find any discovery of importance on this subject. Maurolycus was the first who pretended to have measured the diameters of the two rainbows with much exactness; and he found that of the inner bow to be 45°, and that of the outer bow 56°; from which Descartes takes occasion to observe, how little we can depend upon the observations of those who were not acquainted with the cause of the phenomena.

Clichtovæus, who died in 1543, had maintained, that the second bow is the image of the first, which he thought was evident from the inverted order of the colours. For, said he, when we look into the water, all the images that we see reflected by it are inverted with respect to the objects themselves; the tops of the trees, for instance, that stand near the brink, appearing lower than the roots.

212 Approach towards it made by Fletcher of Breslaw.

As the rainbow was opposite to the sun, it was natural to imagine, that its colours were produced by some kind of reflection of the rays of light from the drops of rain. No person seems to have thought of ascribing these colours to refraction, till one *Fletcher* of Breslaw, in a treatise published in 1571, endeavoured to account for them by means of a double refraction and one reflection. But he imagined that a ray of light, after entering a drop of rain, and suffering a refraction both at its entrance and exit, was afterwards reflected from another drop, before it reaches the eye of the spectator. He seems to have overlooked the reflection at the posterior surface of the drop, or to have imagined that all the bendings of the light within the drop would not make a sufficient curvature to bring the rays of the sun to the eye of the spectator. That he should think of two refractions, was the necessary consequence of his supposing that the ray entered the drop at all. This supposition, therefore, was all that he instituted to explain the phenomena. B. Porta supposed that the rainbow is produced by the refraction of light in the whole body of rain or vapour, but not in the separate drops.

213 The discovery made by Antonio de Dominis bishop of Spalatro.

It is to a man who had no pretensions to philosophy, that we are indebted for the true explanation. This was Antonio De Dominis, bishop of Spalatro, whose treatise *De Radiis Visus et Lucis*, was published by J. Bartolus in 1611. He first maintained, that the double refraction of Fletcher, with an intervening reflection, was sufficient to produce the colours of the bow, and also to bring the rays that formed them to the eye of the spectator, without any subsequent reflection. He distinctly describes the progress of a ray of light entering the upper part of the drop, where it suffers one refraction, and after being thereby thrown upon the back part of the inner surface, is thence reflected to the lower part of the drop; at which place undergoing a second refraction, it is thereby bent, so as to come directly to the eye. To verify this hypothesis, De Dominis proceeded in a very sensible and philosophical manner. He procured a small globe of solid glass, and viewing it when it was exposed to the rays of the sun, in the same manner in which he had supposed that the drops of rain were situated with respect to them, he actually observed the same colours which he had seen in the true rainbow, and in the same order.

Thus the circumstances in which the colours of the rainbow were formed, and the progress of a ray of light through a drop of water, were clearly understood; but philosophers were a long time at a loss when they endeavoured to assign reasons for all the particular colours, and for the order of them. Indeed nothing but the doctrine of the different refrangibility of the rays of light, could furnish a complete solution of this difficulty. De Dominis supposed that the red rays were those which had traversed the least space in the inside of a drop of water, and therefore retained more of their native force, and consequently, striking the eye more briskly, gave it a stronger sensation; that the green and blue colours were produced by those rays, the force of which had been, in some measure, obtunded in passing through a greater body of water; and that all the intermediate colours were composed (according to the hypothesis which generally prevailed at that time) of a mixture of these three primary ones. That the different colours were produced by some difference in the impulse of light upon the eye, was an opinion which had been adopted by many persons, who had ventured to depart from the authority of Aristotle.

Afterwards the same De Dominis observed, that all the rays of the same colour must leave the drop of water in a part similarly situated with respect to the eye, in order that each of the colours may appear in a circle, the centre of which is a point of the heavens, in a line drawn from the sun through the eye of the spectator. The red rays, he observed, must issue from the drop nearest to the bottom of it, in order that the circle of red may be the outermost, and the most elevated in the bow.

Though De Dominis conceived so justly the manner in which the inner rainbow is formed, he was far from having as just an idea of the cause of the exterior bow. This he endeavoured to explain in the very same manner as the interior, viz. by one reflection of the light within the drop, preceded and followed by a refraction; supposing only that the rays which formed the exterior bow were returned to the eye by a part of the drop lower than that which transmitted the red of the interior bow. He also supposed that the rays which formed one of the bows came from the upper limb of the sun, and those which formed the other from the lower limb, without considering that the bows ought thus to have been contiguous; or rather, that an indefinite number of bows would have had their colours all intermixed.

When Sir Isaac Newton discovered the different refrangibility of the rays of light, he immediately applied the discovery to the phenomena of the rainbow, taking up

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up the subject where De Dominis and Descartes were obliged to leave their investigations imperfect.

214 The true cause of the colours of the rainbow. Plate CCCLXXXIII fig. 8.

Let a be a drop of water, and S a pencil of light; which, on its leaving the drop reaches the eye of the spectator. This ray, at its entrance into the drop, begins to be decomposed into its proper colours; and upon leaving the drop, after one reflection and a second refraction, it is farther decomposed into as many small differently-coloured pencils as there are primitive colours in the light. Three of them only are drawn in this figure, of which the blue is the most, and the red the least, refracted.

The theory of the different refrangibility of light enables us to assign a reason for the size of a bow of each particular colour. Newton, having found that the sines of refraction of the most refrangible and least refrangible rays, in passing from rain water into air, are in the ratio of 185 to 182, when the sine of incidence is 138, computed the size of the bow; and found, that if the sun was only a physical point, the breadth of the inner bow would be 2°; and if to this 30′ were added for the apparent diameter of the sun, the whole breadth would be $2\frac{1}{2}$°. But as the outermost colours, especially the violet, are extremely faint, the breadth of the bow will not appear to exceed two degrees. He found by the same principles, that the breadth of the exterior bow, if it was everywhere equally vivid, would be 4° 20′. But in this case there is a greater deduction to be made, on account of the faintness of the light of the exterior bow; so that it will not appear to be more than 3 degrees broad.

The principal phenomena of the rainbow are explained on Sir Isaac Newton's principles in the following propositions.

Prop. I.

When the rays of the sun fall upon a drop of rain and enter into it, some of them, after one reflection and two refractions, may come to the eye of a spectator who has his back towards the sun, and his face towards the drop.

215 Explanation of the phenomena of the rainbow on the principles of Newton. Fig. 9.

If XY be a drop of rain, and if the sun shine upon it in any lines $s\,f$, $s\,d$, $s\,a$, &c. most of the rays will enter into the drop; some of them only will be reflected from the first surface; those rays which are thence reflected do not come under our present consideration, because they are never refracted at all. The greatest part of the rays then enter the drop, and those passing on to the second surface, will most of them be transmitted through the drop. At the second surface or hinder part of the drop, at $p\,g$, some few rays will be reflected, whilst the rest are transmitted; those rays proceed in some such lines as $n\,r$, $n\,q$: and coming out of the drop in the lines $r\,v$, $q\,t$, may fall upon the eye of the spectator, who is placed anywhere in those lines, with his face towards the drop, and consequently with his back towards the sun, which is supposed to shine upon the drop in the lines $s\,f$, $s\,d$, $s\,a$, &c. These rays are twice refracted and once reflected; they are refracted when they pass out of the air into the drop; they are reflected from the second surface, and are refracted again when they pass out of the drop into the air.

Def. When rays of light reflected from a drop of rain come to the eye, those are called *effectual* which are able to excite a sensation.

Prop. II.

When rays of light come out of a drop of rain, they will not be effectual, unless they are parallel and contiguous.

There are but few rays that can come to the eye at all: for since the greatest part of those rays which enter the drop XY between X and a, pass out of the drop through the hinder surface $p\,g$; only few are thence reflected, and come out through the nearer surface between a and Y. Now, such rays as emerge, or come out of the drop, between a and Y, will be ineffectual, unless they are parallel to one another, as $r\,v$ and $q\,t$ are; because such rays as come out diverging from one another will be so far asunder when they come to the eye, that all of them cannot enter the pupil; and the very few that can enter it will not be sufficient to excite any sensation. But even rays, which are parallel, as $r\,v$, $q\,t$, will not be effectual, unless there are several of them contiguous or very near to one another. The two rays $r\,v$ and $q\,t$ alone will not be perceived, though both of them enter the eye; for so very few rays are not sufficient to excite a sensation. Fig. 9.

Prop. III.

When rays of light come out of a drop of rain after one reflection, those will be effectual which are reflected from the same point, and which entered the drop near to one another.

Any rays, as $s\,b$ and $c\,d$, when they have passed out of the air into a drop of water, will be refracted towards the perpendiculars $b\,l$, $d\,l$; and as the ray $s\,b$ falls farther from the axis $a\,v$ than the ray $c\,d$, $s\,b$ will be more refracted than $c\,d$; so that these rays, though parallel to one another at their incidence, may describe the lines $b\,e$ and $d\,e$ after refraction, and be reflected from the same point e. Now all rays, which are thus reflected from the same point, when they have described the lines $e\,f$, $e\,g$, and after reflection emerge at f and g, will be so refracted, when they pass out of the drop into the air, as to describe the parallel lines $f\,h$, $g\,i$. If these rays were to return from e in the lines $e\,b$, $e\,d$, and were to emerge at b and d, they would be refracted into the lines of their incidence $b\,s$, $d\,c$. But if these rays, instead of being returned in the lines $e\,b$, $e\,d$, are reflected from the same point e in the lines $e\,g$, $e\,f$, the lines of reflection $e\,g$ and $e\,f$ will be inclined to one another and to the surface of the drop, just as much as the lines $e\,b$ and $e\,d$ are. First, $e\,b$ and $e\,g$ make the same angle with the surface of the drop; for the angle $b\,e\,x$, which $e\,b$ makes with the surface of the drop, is the complement of incidence, and the angle $g\,e\,v$, which $e\,g$ makes with the surface, is the complement of reflection; and these two are equal to one another. In the same manner it might be shown, that $e\,d$ and $e\,f$ make equal angles with the surface of the drop. Secondly, The angle $b\,e\,d = f\,e\,g$; or the reflected rays $e\,g$, $e\,f$, and the incident rays $b\,e$, $d\,e$, are equally inclined to each other. For the angle of incidence $b\,e\,l = g\,e\,l$, the angle of reflection, and the angle of incidence $d\,e\,l = f\,e\,l$, the angle Plate CCLXXXIII fig. 10.

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angle of reflection: consequently, the difference between the angles of incidence is equal to the difference between the angles of reflection, or $b\,e\,l - d\,e\,l = g\,e\,l - f\,e\,l$, or $b\,e\,d = g\,e\,f$. Since therefore either the lines $e\,g$, $e\,f$, or the lines $e\,b$, $e\,d$, are equally inclined both to one another and to the surface of the drop; the rays will be refracted in the same manner, whether they return in the lines $e\,b$, $e\,d$, or are reflected in the lines $e\,g$, $e\,f$. But if they return in the lines $e\,b$, $e\,d$, the refraction, when they emerge at b and d, would make them parallel. Therefore, if they are reflected from one and the same point e in the lines $e\,g$, $e\,f$, the refraction, when they emerge at g and f, will likewise make them parallel.

But though such rays as are reflected from the same point in the hinder part of a drop of rain, are parallel to one another when they emerge, and so have one condition that is requisite towards making them effectual, yet there is another condition necessary; for rays that are effectual must be contiguous as well as parallel. And though rays, which enter the drop in different places, may be parallel when they emerge, those only will be contiguous which enter it nearly at the same place.

Fig. 9. Let XY be a drop of rain, $a\,g$ the axis or diameter of the drop, and $s\,a$ a ray of light that enters the drop at a. This ray $s\,a$, being perpendicular to both the surfaces, will pass through the drop in the line $a\,g\,h$ without being refracted; but any collateral rays, such as those that fall about $s\,b$, will be made to converge to the axis, and passing out at n will meet the axis at h: Rays which fall farther from the axis than $s\,b$, such as those which fall about $s\,c$, will likewise be made to converge; but their focus will be nearer to the drop than h. Suppose therefore i to be the focus of the rays that fall about $s\,c$, any ray $s\,c$, when it has described the line $c\,o$ within the drop, and is tending to the focus i, will pass out of the drop at the point o. The rays that fall upon the drop about $s\,d$, will converge to a focus still nearer than i, as at k. These rays therefore go out of the drop at p. The rays, that fall about $s\,c$, will converge to a focus nearer than k, as suppose at l; and the ray $s\,e$, when it has described the line $e\,o$ within the drop, and is tending to l, will pass out at the point o. The rays that fall still more remote from the axis will converge to a focus still nearer Thus the ray $s\,f$ will after refraction converge to a focus at m, which is nearer than l; and having described the line $f\,n$ within the drop, it will pass out to the point n. Now we may here observe, that as any rays $s\,b$ or $s\,c$, fall farther above the axis $s\,a$, the points n, or o, where they pass out behind the drop, will be farther above g; or that, as the incident ray rises from the axis $s\,a$, the arc $g\,n\,o$ increases, till we come to some ray $s\,d$, which passes out of the drop at p; and this is the highest point where any ray that falls upon the quadrant or quarter $a\,x$ can pass out: for any rays $f\,e$, or $s\,f$, that fall higher than $s\,d$, will not pass out on any point above p, but at the points o, or n, which are below it. Consequently, though the arc $g\,n\,o\,p$ increases, whilst the distance of the incident ray from the axis $s\,a$ increases, till we come to the ray $s\,d$; yet afterwards, the higher the ray falls above the axis $s\,a$, this arc $p\,o\,n\,g$ will decrease.

We have hitherto spoken of the points on the posterior part of the drop, where the rays pass out of it; but this was for the sake of determining the points from which those rays are reflected, which do not pass out behind the drop. For, in explaining the rainbow, we have no further reason to consider those rays which go through the drop; since they can never come to the eye of a spectator placed anywhere in the lines $r\,v$ or $q\,t$ with his face towards the drop. Now, as there are many rays which pass out of the drop between g and p, so some rays will be thence reflected: and consequently the several points between g and p, which are the points where some of the rays pass out of the drop, are likewise the points of reflection for the rest which do not pass out. Therefore in respect of those rays which are reflected, we may call $g\,p$ the arc of reflection; and may say, that this arc of reflection increases, as the distance of the incident ray from the axis $s\,a$ increases, till we come to the ray $s\,d$; the arc of reflection is $g\,n$ for the ray $s\,b$, it is $g\,o$ for the ray $s\,c$, and $g\,p$ for the ray $s\,d$. But after this, as the distance of the incident ray from the axis $s\,a$ increases, the arc of reflection decreases; for $o\,g$ less than $p\,g$ is the arc of reflection for the ray $s\,e$, and $n\,g$ is the arc of reflection for the ray $s\,f$.

Hence it is obvious, that some ray, which falls above $s\,d$, may be reflected from the same point with some other ray which falls below $s\,d$. Thus, for instance, the ray $s\,b$ will be reflected from the point n, and the rays $s\,f$ will be reflected from the same point; and consequently, when the reflected rays $n\,r$, $n\,q$, are refracted as they pass out of the drop at r and q, they will be parallel. But since the intermediate rays, which enter the drop between $s\,f$ and $s\,b$, are not reflected from the same point n, these two rays alone will be parallel to one another when they come out of the drop, and the intermediate rays will not be parallel to them. And consequently these rays $r\,v$, $q\,t$, though they are parallel after they emerge at r and q, will not be contiguous, and for that reason will not be effectual; the ray $s\,d$ is reflected from p, which has been shown to be the limit of the arc of reflection; such rays as fall just above $s\,d$, and just below $s\,d$, will be reflected from nearly the same point p, as appears from what has been already shown. These rays therefore will be parallel, because they are reflected from the same point p; and they will likewise be contiguous, because they all of them enter the drop at the same place very near to d. Consequently, such rays as enter the drop at d, and are reflected from p the limit of the arc of reflection, will be effectual; since, when they emerge at the part of the drop between a and y, they will be both parallel and contiguous.

If it can be shown that the rainbow is produced by the rays of the sun which are thus reflected from drops of rain as they fall while the run shines upon them, this proposition may serve to show us, that this appearance is not produced by *any* rays that fall upon *any part*, and are reflected from any part of those drops: since this appearance cannot be produced by any rays but those which are effectual; and effectual rays must always enter each drop at one certain place in the anterior part of it, and must likewise be reflected from one certain place in the posterior surface.

Prop. IV.

When rays that are effectual emerge from a drop of rain after one reflection and two refractions, those which are most refrangible will, at

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at their immersion, make a less angle with the incident rays than those which are least refrangible; and by this means the rays of different colours will be separated from one another.

Plate ccclxxxiii. fig. 10.

Let $f h$ and $g i$ be effectual violet rays emerging from the drop at $f g$; and $f n$, $g p$, effectual red rays emerging from the same drop at the same place. Now, though all the violet rays are parallel to one another, because they are supposed effectual, and though all the red rays are likewise parallel to one another from the same reason; yet the violet rays will not be parallel to the red rays. These rays, as they have different degrees of refrangibility, will diverge from one another; any violet ray $g i$, which emerges at g, will diverge from any red ray $g p$, which emerges at the same place. Now, both the violet ray $g i$, and the red ray $g p$, as they pass out of the drop of water into the air, will be refracted from the perpendicular $l o$. But the violet ray is more refrangible than the red one; and for that reason $g i$, or the refracted violet ray, will make a greater angle with the perpendicular than $g p$ the refracted red ray; or the angle $i g o$ will be greater than the angle $p g o$. Suppose the incident ray $s b$ to be continued in the direction $s k$, and the violet ray $i g$ to be continued backward in the direction $i k$, till it meets the incident ray at k. Suppose likewise the red ray $p g$ to be continued backwards in the same manner, till it meets the incident ray at w. The angle $i k s$ is that which the violet ray, or most refrangible ray at its immersion, makes with the incident ray; and the angle $p w s$, is that which the red ray or least refrangible ray at its immersion, makes with the incident ray. The angle $i k s$ is less than the angle $p w s$. For, in the triangle, $g w k$, $g w s$, or $p w s$, is the external angle at the base, and $g k w$ or $i k s$ is one of the internal opposite angles. (Euc. B. I. Prop. xvi.). What has been shown to be true of the rays $g i$ and $g p$ might be shown in the same manner of the rays $f h$ and $f n$, or of any other rays that emerge respectively parallel to $g i$ and $g p$. But all the effectual violet rays are parallel to $g i$, and all the effectual red rays are parallel to $g p$. Therefore the effectual violet rays at their immersion make a less angle with the incident ones than the effectual red ones. For the same reason, in all the other sorts of rays, those which are most refrangible, at their emersion from a drop of rain after one reflection, will make a less angle with the incident rays, than those do which are less refrangible.

Otherwise: When the rays $g i$ and $g p$ emerge at the same point g, as they both come out of the water into air, and consequently are refracted from the perpendicular, instead of going straight forwards in the line $e g$ continued, they will both be turned round upon the point g from the perpendicular $g o$. Now it is easy to conceive, that either of these lines might be turned in this manner upon the point g as upon a centre, till they became parallel to $s b$ the incident ray. But if either of these lines or rays were refracted so much from $g o$ as to become parallel to $s b$, the ray thus refracted, would, after emersion, make no angle with $s k$, because it would be parallel to it. Consequently that ray which is most turned round upon the point g, or that ray which is most refrangible, will after emersion be nearest parallel to the incident ray, or will make the least angle with it. The same may be proved of all other rays emerging parallel to $g i$ and $g p$ respectively, or of all effectual rays; those which are most refrangible will after emersion make a less angle with the incident rays, than those do which are least refrangible.

But since the effectual rays of different colours make different angles with $s k$ at their emersion, they will be separated from one another: so that if the eye were placed in the beam $f g h i$, it would receive only rays of one colour from the drop $x a g v$; and if it were placed in the beam $f g n p$, it would receive only rays of some other colour.

The angle $s w p$, which the least refrangible or red rays make with the incident ones when they emerge so as to be effectual, is found by calculation to be $42^\circ\ 2'$. And the angle $s k i$, which the most refrangible rays make with the incident ones when they emerge so as to be effectual, is found to be $40^\circ\ 17'$. The rays which have the intermediate degrees of refrangibility, make with the incident ones intermediate angles between $42^\circ\ 2'$, and $40^\circ\ 17'$.

Prop. V.

If a line be supposed to be drawn from the centre of the sun through the eye of the spectator, the angle which any effectual ray, after two refractions and one reflection, makes with the incident ray, will be equal to the angle which it makes with that line.

Let the eye of the spectator be at i, and let $q t$ be the line supposed to be drawn from the centre of the sun through the eye of the spectator; the angle $g i t$, which any effectual ray makes with this line, will be equal to the angle $i k s$, which the same ray makes with the incident ray $s b$ or $s k$. If $s b$ is a ray coming from the centre of the sun, then since $q t$ is supposed to be drawn from the same point, these two lines, upon account of the remoteness of the point from whence they are drawn, may be looked upon as parallel to one another. But the right line $k i$ crossing these two parallel lines will make the alternate angles equal. (Euc. B. I. Prop. xxix.). Therefore $k i t$ or $g i t = s k i$.

Plate ccclxxxiii. fig. 10.

Prop. VI.

When the sun shines upon the drops of rain as they are falling, the rays that come from those drops to the eye of a spectator, after one reflection and two refractions, produce the primary rainbow.

216 Two rainbows seen at once. Fig. 11.

If the sun shines upon the rain as it falls, there are commonly seen two bows, as AFB, CHD; or if the cloud and rain does not reach over that whole side of the sky where the bows appear, then only a part of one or of both bows is seen in that place where the rain falls. Of these two bows, the innermost AFB is the more vivid of the two, and this is called the *primary bow*. The outer part TFY of the primary bow is red, the inner part VEX is violet; the intermediate parts, reckoning from the red to the violet, are orange, yellow, green, blue, and indigo. Suppose the spectator's eye to be at O, and let LOP be an imaginary line drawn

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drawn from the centre of the sun through the eye of the spectator: if a beam of light S coming from the sun fall upon any drop F; and the rays that emerge at F in the line FO, so as to be effectual, make an angle FOP of 42° 2′ with the line LP; then these effectual rays make an angle of 42° 2′ with the incident rays, by the preceding proposition, and consequently these rays will be red, so that the drop F will appear red. All the other rays, which emerge at F, and would be effectual if they fell upon the eye, are refracted more than the red ones, and consequently will pass above the eye. If a beam of light S fall upon the drop E, and the rays that emerge at E in the line EO, so as to be effectual, make an angle of 40° 17′ with the line LP; then these effectual rays make likewise an angle of 40° 17′ with the incident rays, and the drop E will appear of a violet colour. All the other rays, which emerge at E, and would be effectual if they came to the eye, are refracted less than the violet ones, and therefore pass below the eye. The intermediate drops between F and E will for the same reasons be of the intermediate colours.

Thus we have shown why a set of drops from F to E, as they are falling, should appear of the seven primary colours. It is not necessary that the several drops, which produce these colours, should all of them fall at exactly the same distance from the eye. The angle FOP, for example, is the same whether the distance of the drop from the eye is OF, or whether it is in any other part of the line OF something nearer to the eye. And whilst the angle FOP is the same, the angle made by the emerging and incident rays, and consequently the colour of the drop, will be the same. This is equally true of any other drop. So that though in the figure the drops F and E are represented as falling perpendicularly one under the other, yet this is not necessary in order to produce the bow.

But the coloured line FE, which we have already accounted for, is only the breadth of the bow. It still remains to be shewn, why not only the drop F should appear red, but why all the other drops from A to B in the arc ATFYB should appear of the same colour. Now it is evident, that wherever a drop of rain is placed, if the angle which the effectual rays make with the line LP is equal to the angle FOP, that is, if the angle which the effectual rays make with the incident rays is 42° 2′, any of those drops will be red, for the same reason that the drop F is of this colour.

If FOP were to turn round upon the line OP, so that one end of this line should always be at the eye, and the other be at P opposite to the sun; such a motion of this figure would be like that of a pair of compasses turning round upon one of the legs OP with the opening FOP. In this revolution the drop F would describe a circle, P would be the centre, and ATFYB would be an arc in this circle. Now since, in this motion of the line and drop OF, the angle made by FO with OP, that is, the angle FOP, continues the same; if the sun were to shine upon this drop as it revolves, the effectual rays would make the same angle with the incident rays, in whatever part of the arc ATFYB the drop was to be. Therefore, whether the drop be at A, or at T, or at Y, or at B, or wherever else it is in this whole arc, it would appear red, as it does at F.—The drops of rain, as they fall, are not indeed turned round in this manner: but then, as great numbers of them are falling at once in right lines from the cloud, whilst one drop is at F, there will be others at Y, at T, at B, at A, and in every other part of the arc ATFYB: and all these drops will be red for the same reason that the drop F would have been red, if it had been in the same place. Therefore, when the sun shines upon the rain as it falls, there will be a red arc ATFYB opposite to the sun. In the same manner, because the drop E is violet, we might prove that any other drop, which, whilst it is falling, is in any part of the arc AVEXB, will be violet; and consequently, at the same time that the red arc ATFYB appears, there will likewise be a violet arc AVEXB below or within it. FE is the distance between these two coloured arcs; and from what has been said, it follows, that the intermediate space between these two arcs will be filled up with arcs of the intermediate colours, orange, yellow, blue, green, and indigo. All these coloured arcs together make up the primary rainbow.

Prop. VII.

The primary rainbow is never a greater arc than a semicircle.

Plate cclxxxiii. fig. 9.

217 Why the arc of the primary rainbow is never greater than a semicircle.

Since the line LOP is drawn from the sun through the eye of the spectator, and since P is the centre of the rainbow; it follows, that the centre of the rainbow is always opposite to the sun. The angle FOP is an angle of 40° 2′, as was observed, or F the highest part of the bow is 42° 2′ from P the centre of it. If the sun is more than 42° 2′ high, P the centre of the rainbow, which is opposite to the sun, will be more than 42° 2′ below the horizon; and consequently F the top of the bow, which is only 42° 2′ from P, will be below the horizon; that is, when the sun is more than 42° 2′ high, no primary rainbow will be seen. If the altitude of the sun be something less than 40° 2′, then P will be something less than 42° 2′ below the horizon; and consequently F, which is only 42° 2′ from P, will be just above the horizon; that is, a small part of the bow at this height of the sun will appear close to the ground opposite to the sun. If the sun be 20° high, then P will be 20° below the horizon; and F the top of the bow, being 42° 2′ from P, will be 22° 2′ above the horizon; therefore, at this height of the sun, the bow will be an arc of a circle whose centre is below the horizon; and consequently that arc of the circle which is above the horizon, or the bow, will be less than a semicircle. If the sun be in the horizon, then P, the centre of the bow, will be in the opposite part of the horizon; F, the top of the bow, will be 42° 2′ above the horizon; and the bow itself, because the horizon passes through the centre of it, will be a semicircle. More than a semicircle can never appear; because if the bow were more than a semicircle, P the centre of it must be above the horizon; but P is always opposite to the sun, therefore P cannot be above the horizon, unless the sun is below it; and when the sun is set, or is below the horizon, it cannot shine upon the drops of rain as they fall; and consequently, when the sun is below the horizon, no bow at all can be seen.

Prop VIII.

When the rays of the sun fall upon a drop of rain, some of them, after two reflections and two refractions,

Of the Rainbow.

fractions, may come to the eye of a spectator, who has his back towards the sun and his face towards the drop.

Fig. 12. If HGW is a drop of rain, and parallel rays coming from the sun, as $z v$, $y w$, fall upon the lower part of it, they will be refracted towards the perpendiculars $v l$, $w l$, as they enter into it, and will describe some such lines as $v h$, $w i$. At h and i great part of these rays will pass out of the drop; but some of them will be reflected from thence in the lines $h f$, $i g$. At f and g again, great part of the rays that were reflected thither will pass out of the drop. But these rays will not come to the eye of a spectator at o. Here, however, all the rays will not pass out; but some will be reflected from f and g, in some such lines as $f d$, $g h$; and these, when they emerge out of the drop of water into the air at b and d, will be refracted from the perpendiculars, and, describing the lines $d t$, $b o$, may come to the eye of the spectator who has his back towards the sun and his face towards the drop.

Prop. IX.

Those rays, which are parallel to one another after they have been once refracted and once reflected in a drop of rain, will be effectual when they emerge after two refractions and two reflections.

No rays can be effectual, unless they are contiguous and parallel. It appears from what was said, that when rays come out of a drop of rain contiguous to one another, either after one or after two reflections, they must enter the drop nearly at the same place. And if such rays as are contiguous are also parallel after the first reflection, they will emerge parallel, and therefore will be effectual. Let $z v$ and $y w$ be contiguous rays which come from the sun, and are parallel when they fall upon the lower part of the drop; suppose these rays to be refracted at v and w, and to be reflected at h and i; if they are parallel, as $h f$, $g i$, after this first reflection, then, after they are reflected a second time from f and g, and refracted a second time as they emerge at d and b, they will go out of the drop in the parallel lines $d t$ and $b o$, and will therefore be effectual.

The rays $z v$, $y w$, are refracted towards the perpendiculars $v l$, $w l$, when they enter the drop, and will be made to converge. As these rays are very oblique, their focus will not be far from the surface $v w$. If this focus be at k, the rays, after they have passed the focus, will diverge from thence in the directions $k h$, $k i$; and if $k i$ is the principal focal distance of the concave reflecting surface $h i$, the reflected rays $h f$, $i g$, will be parallel. These rays $e f$, $i g$, are reflected again from the concave surface $f g$, and will meet in a focus at e, so that $g e$ will be the principal focal distance of this reflecting surface $f g$. And because $h i$ and $f g$ are parts of the same sphere, the principal focal distances $g e$ and $k i$ will be equal. When the rays have passed the focus e, they will thence diverge in the line $e d$, $e b$: and we are to show, that when they emerge at d and b, and are refracted there, they will become parallel.

Now if the rays $v k$, $w k$, when they have met at k, were to be turned back again in the directions $k v$, $k w$, and were to emerge at v and w, they would be refracted into the lines of their incidence, $v z$, $w y$, and therefore would be parallel. But since $g e = i k$, as has already been shown, the rays $e d$, $e b$, that diverge from e, fall in the same manner upon the drop at d and b, as the rays $k v$, $k w$, would fall upon it at v and w; and $e d$, $e b$, are just as much inclined to the refracting surface $d b$, as $k v$, $k w$ would be to the surface $v w$. Hence it follows, that the rays $e d$, $e b$, emerging at d and b, will be refracted in the same manner, and will have the same direction in respect of one another, as $k v$, $k w$ would have. But $k v$ and $k w$ would be parallel after refraction. Therefore the rays $e d$ and $e b$ will emerge in the lines $d p$, $b o$, parallel to one another, and consequently effectual.

Prop. X.

When rays that are effectual emerge from a drop of rain after two reflections and two refractions, those which are most refrangible will at their emersion make a greater angle with the incident rays than those do which are least refrangible; and by this means the rays of different colours will be separated from one another.

If rays of different colours, which are differently refrangible, emerge at any point b, these rays will not be all of them equally refracted from the perpendicular. Plate CCCLXXXIII. fig. 12. Thus, if $b o$ is a red ray, which is of all others the least refrangible, and $b m$ is a violet ray, which is of all others the most refrangible; when these two rays emerge at b, the violet ray will be refracted more from the perpendicular $b x$ than the red ray, and the refracted angle $x b m$ will be greater than the refracted angle $x b o$. Hence it follows, that these two rays, after emersion, will diverge from one another. In like manner, the rays that emerge at d will diverge from one another; a red ray will emerge in the line $d p$, a violet ray in the line $d t$. So that though all the effectual red rays of the beam $b d m t$ are parallel to one another, and all the effectual red rays of the beam $b d o p$ are likewise parallel, yet the violet will not be parallel to the red beam. Thus the rays of different colours will be separated from one another.

This will appear farther, if we consider what the proposition affirms, That any violet or most refrangible ray will make a greater angle with the incident rays, than any red or least refrangible ray makes with the same incident rays. Thus if $y w$ be an incident ray, $b m$ a violet ray emerging from the point b, and $b o$ a red ray emerging from the same point; the angle which the violet ray makes with the incident one is $y r m$, and that which the red ray makes with it is $y s o$. Now $y r m$ is greater than $y s o$. For in the triangle $b r s$, the internal angle $b r s$ is less than $b s y$ the external angle at the base. (Eucl. B. I. Prop. xvi.). But $y r m$ is the complement of $b r s$ or of $b r y$ to two right ones, and $y s o$ is the complement of $b s y$ to two right ones. Therefore, since $b r y$ is less than $b s y$, the complement of $b r y$ to two right angles will be greater than the complement of $b s y$ to two right angles; or $y r m$ will be greater than $y s o$.

Otherwise: Both the rays $b o$ and $b m$, when they are refracted in passing out of the drop at b, are turned round upon the point b from the perpendicular $b x$. Now either of these lines $b o$ or $b m$ might be turned round

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round in this manner, till it made a right angle with $y\ w$. Consequently, that ray which is most turned round upon b, or which is most refracted, will make an angle with $y\ w$, that will be nearer to a right one than that ray makes with it which is least turned round upon b, or which is least refracted. Therefore that ray which is most refracted will make a greater angle with the incident ray than that which is least refracted.

But since the emerging rays, being differently refrangible, make different angles with the same incident ray $y\ w$, the refraction which they suffer at emersion will separate them from one another.

The angle $y\ r\ m$, which the most refrangible or violet rays make with the incident ones, is found by calculation to be $54^\circ\ 7'$; and the angle $y\ s\ o$, which the least refrangible or red rays make with the incident ones, is found to be $50^\circ\ 57'$: the angles, which the rays of the intermediate colours, indigo, blue, green, yellow, and orange, make with the incident rays, are intermediate angles between $54^\circ\ 7'$ and $50^\circ\ 57'$.

Prop. XI.

If a line is supposed to be drawn from the centre of the sun through the eye of the spectator; the angle which, after two refractions and two reflections, any effectual ray makes with the incident ray, will be equal to the angle which it makes with that line.

Fig. 12. If $y\ w$ is an incident ray, $b\ o$ an effectual ray, and $q\ n$ a line drawn from the centre of the sun through o the eye of the spectator; the angle $y\ s\ o$, which the effectual ray makes with the incident ray, is equal to $s\ o\ n$ the angle which the same effectual ray makes with the line $q\ n$. For $y\ w$ and $q\ n$, considered as drawn from the centre of the sun, are parallel; bo crosses them, and consequently makes the alternate angles $y\ s\ o$, $s\ o\ n$, equal to one another. Eucl. B. I. Prop. xxix.

Prop. XII.

When the sun shines upon the drops of rain as they are falling, the rays, that come from these drops to the eye of a spectator, after two reflections and two refractions, produce the secondary rainbow.

218 The secondary rainbow produced by two reflections and two refractions. Fig. 11.

The secondary rainbow is the outermost CHD. When the sun shines upon a drop of rain H; and the rays HO, which emerge at H so as to be effectual, make an angle HOP of $54^\circ\ 7'$ with LOP a line drawn from the sun through the eye of the spectator; the same effectual rays will make likewise an angle of $54^\circ\ 7'$ with the incident rays S, and the rays which emerge at this angle are violet ones, by what was observed above. Therefore, if the spectator's eye is at O, none but violet rays will enter it: for as all the other rays make a less angle with OP, they will fall above the spectator's eye. In like manner, if the effectual rays that emerge from the drop G make an angle of $50^\circ\ 57'$ with the line OP, they will likewise make the same angle with the incident rays S; and consequently, from the drop G no rays will come to the spectator's eye at O but red ones; for all the other rays making a greater angle with the line OP, will fall below the eye at O. For the same reason, the rays emerging from the intermediate drops between H and G, and coming to the spectator's eye at O, will emerge at intermediate angles, and therefore will have the intermediate colours. Thus if there are seven drops from H to G inclusively, their colours will be violet, indigo, blue, green, yellow, orange, and red. This coloured line is the breadth of the secondary rainbow.

Now, if HOP were to turn round upon the line OP, like a pair of compasses upon one of the legs OP with the opening HOP, it is plain from the supposition, that, in such a revolution of the drop H, the angle HOP would be the same, and consequently the emerging rays would make the same angle with the incident ones. But in such a revolution the drop would describe a circle of which P would be the centre, and CNHRD an arc. Consequently, since, when the drop is at N, or at R, or anywhere else in that arc, the emerging rays make the same angle with the incident ones as when the drop is at H, the colour of the drop will be the same to an eye placed at O, whether the drop is at N, or at H, or at R, or anywhere else in that arc. Now, though the drop does not thus turn round as it falls, and does not pass through the several parts of this arc, yet, since there are drops of rain falling everywhere at the same time, when one drop is at H, there will be another at R, another at N, and others in all parts of the arc; and these drops will all be violet-coloured, for the same reason that the drop H would have been of this colour if it had been in any of those places. In like manner, as the drop G is red when it is at G, it would likewise be red in any part of the arc CWGQD; and so will any other drop when, as it is falling, it comes to any part of that arc. Thus as the sun shines upon the rain, whilst it falls, there will be two arcs produced, a violet-coloured arc CNHRD, and a red one CWGQD; and for the same reasons the intermediate space between these two arcs will be filled up with arcs of the intermediate colours. All these arcs together make up the secondary rainbow.

Prop. XIII.

The colours of the secondary rainbow are fainter than those of the primary rainbow; and are arranged in the contrary order.

The primary rainbow is produced by such rays as have been only once reflected; the secondary rainbow is produced by such rays as have been twice reflected. But at every reflection some rays pass out of the drop of rain without being reflected; so that the oftener the rays are reflected, the fewer of them are left. Therefore the colours of the secondary bow are produced by fewer rays, and consequently will be fainter, than the colours of the primary bow. 219 Why the colours of the secondary rainbow are fainter than those of the primary, and arranged in a contrary order.

In the primary bow, reckoning from the outside of it, the colours are arranged in this order; red, orange, yellow, green, blue, indigo, violet. In the secondary bow, reckoning from the outside, the colours are violet, indigo, blue, green, yellow, orange, red. So that the red, which is the outermost or highest colour in the primary bow, is the innermost or lowest colour in the secondary one.

Now the violet rays, when they emerge so as to be effectual

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Plate CCCLXXXIII. fig. 11.

effectual after one reflection, make a less angle with the incident rays than the red ones; consequently the violet rays make a less angle with the lines OP than the red ones. But, in the primary rainbow, the rays are only once reflected, and the angle which the effectual rays make with OP is the distance of the coloured drop from P the centre of the bow. Therefore the violet drops, or violet arc, in the primary bow, will be nearer to the centre of the bow than the red drops or red arc; that is, the innermost colour in the primary bow will be violet, and the outermost colour will be red. And, for the same reason, through the whole primary bow, every colour will be nearer the centre P, as the rays of that colour are more refrangible.

But the violet rays, when they emerge so as to be effectual after two reflections, make a greater angle with the incident rays than the red ones; consequently the violet rays will make a greater angle with the line OP, than the red ones. But in the secondary rainbow the rays are twice reflected, and the angle which the effectual rays make with OP is the distance of the coloured drop from P the centre of the bow. Therefore the violet drops or violet arc in the secondary bow will be farther from the centre of the bow, than the red drops or red arc; that is, the outermost colour in the secondary bow will be violet, and the innermost colour will be red. And, for the same reason, through the whole secondary bow, every colour will be farther from the centre P, as the rays of that colour are more refrangible.

Sect. II. *Of Coronas, Parhelia, &c.*

Under the articles Corona and Parhelion, a pretty full account is given of the different hypotheses concerning these phenomena, and likewise of the method by which these hypotheses are supported, from the known laws of refraction and reflection. See also the article Chromatics in the Supplement.

Sect. III. *Of the Concave Figure of the Sky.*

220 Extent of the visible horizon on a plane surface.

The apparent concavity of the sky is only an optical deception founded on the incapacity of our organs of vision to take in very large distances. Dr Smith has demonstrated, that, if the surface of the earth were perfectly plane, the distance of the visible horizon from the eye would scarcely exceed the distance of 5000 times the height of the eye above the ground: beyond this distance, all objects would appear in the visible horizon. For, let OP be the height of the eye above the line PA drawn upon the ground; and if an object AB=PO, be removed to a distance PA equal to 5000 times that height, it will hardly be visible by reason of the smallness of the angle AOB. Consequently any distance AC, however great, beyond A, will be invisible. For since AC and BO are parallel, the ray CO will always cut AB in some point D between A and B; and therefore the angle AOC, or AOD, will always be less than AOB, and therefore AD or AC will be invisible. Consequently all objects and clouds, as CE and FG, placed at all distances beyond A, if they be high enough to be visible, or to subtend a bigger angle at the eye than AOB, will appear at the horizon AB; because the distance AC is invisible.

Plate CCCLXXXIV. fig. 8.

221 Why a long row of objects appears circular. Fig. 9.

Hence, if we suppose a long row of objects, or a long wall ABZY, built upon this plane, and its perpendicular distance OA from the eye at O to be equal to or greater than the distance O *a* of the visible horizon, it will not appear straight, but circular, as if it were built upon the circumference of the horizon *a c e g y*: and if the wall be continued to an immense distance, its extreme parts YZ will appear in the horizon at *y z*, where it is cut by a line O *y* parallel to the wall. For, supposing a ray YO, the angle YO *y* will become insensibly small. Imagine this infinite plane OAY *y*, with the wall upon it, to be turned about the horizontal line O like the lid of a box, till it becomes perpendicular to the other half of the horizontal plane LM *y*, and the wall parallel to it, like a vast ceiling overhead; and then the wall will appear like the concave figure of the clouds overhead. But though the wall in the horizon appear in the figure of a semicircle, yet the ceiling will not, but much flatter. Because the horizontal plane was a visible surface, which suggested the idea of the same distances quite round the eye: but in the vertical plane extended between the eye and the ceiling, there is nothing that affects the sense with an idea of its parts but the common line O *y*; consequently the apparent distances of the higher parts of the ceiling will be gradually diminished in ascending from that line. Now when the sky is overcast with clouds of equal gravities, they will all float in the air at equal heights above the earth, and consequently will compose a surface resembling a large ceiling, as flat as the visible surface of the earth. Its concavity therefore is only apparent: and when the heights of the clouds are unequal, since their real shapes and magnitudes are all unknown, the eye can seldom distinguish the unequal distances of those clouds that appear in the same directions, unless when they are very near us, or are driven by contrary currents of the air. So that the visible shape of the whole surface remains alike in both cases. And when the sky is either partly overcast or partly free from clouds, it is matter of fact that we retain much the same idea of its concavity as when it was quite overcast.

222 Why the concavity of the sky appears less than a hemisphere.

The concavity of the heavens appears to the eye, which is the only judge of an apparent figure, to be a less portion of a spherical surface than a hemisphere. Dr Smith says, that the centre of the concavity is much below the eye: and by taking a medium among several observations he found the apparent distance of its parts at the horizon to be generally between three and four times greater than the apparent distance of its parts overhead. For let the arch ABCD represent the apparent concavity of the sky, O the place of the eye, OA and OC the horizontal and vertical apparent distances, whose proportion is required. First observe when the sun or the moon, or any cloud or star, is in such a situation at B, that the apparent arches BA, BC, extended on each side of this object towards the horizon and zenith, seem equal to the eye; then taking the altitude of the object B with a quadrant, or a cross staff, or finding it by astronomy from the given time of observation, the angle AOB is known. Drawing therefore the line OB in the position thus determined, and taking in it any point B, in the vertical line CO produced downwards, find the centre E of a circle ABC, whose arches BA, BC, intercepted between B and the legs of the right angle AOC, shall be equal to each other; then will this arch ABCD represent

Fig. 10.

Blue colour of the Sky. present the apparent figure of the sky. For by the eye we estimate the distance between any two objects in the heavens by the quantity of sky that appears to lie between them; as upon earth we estimate it by the quantity of ground that lies between them. The centre E may be found geometrically by constructing a cubic equation, or as quickly and sufficiently exact by trying whether the chords BA, BC, of the arch ABC drawn by conjecture are equal, and by altering its radius BE till they are so. Now in making several observations upon the sun, and some others upon the moon and stars, they seemed to our author to bisect the vertical arch ABC at B, when their apparent altitudes or the angle AOB was about 23 degrees; which gives the proportion of OC to OA as 3 to 10 or as 1 to $3\frac{1}{3}$ nearly. When the altitude of the sun was 30°, the upper arch seemed always less than the under one; and, in our author's opinion, always greater when the sun was about 18 or 20 degrees high.

Sect. IV. *Of the Blue Colour of the Sky, and of Blue and Green Shadows.*

223 Opinions of the ancients respecting the colour of the sky. The opinions of ancient writers concerning the colour of the sky merit no notice. The first who gave any rational explanation was Fromondus. He supposed that the blueness of the sky proceeded from a mixture of the white light of the sun with the black space beyond the atmosphere, where there is neither refraction nor reflection. This opinion very generally prevailed, and was maintained by Otto Guerick and all his contemporaries, who asserted, that white and black may be mixed in such a manner as to make a blue. M. Bouguer had recourse to the vapours diffused through the atmosphere, to account for the reflection of the blue rays rather than any other. He seems, however, to suppose, that it arises from the constitution of the air itself, from which the fainter-coloured rays are incapable of making their way through any considerable tract of it. Hence he is of opinion, that the colour of the air is properly blue; to which opinion Dr Smith seems also to have inclined.

To this blue colour of the sky is owing the appearance of blue and green shadows in the morning and evening.—

224 Green shadows observed by M. Buffon. These were first observed by M. Buffon in 1742, when he noticed that the shadows of trees which fell upon a white wall were green. He was at that time standing upon an eminence, and the sun was setting in the cleft of a mountain, so that he appeared considerably lower than the horizon. The sky was clear, excepting in the west, which, through free from clouds, was lightly shaded with vapours, of a yellow colour, inclining to red. Then the sun itself was exceedingly red, and was apparently at least four times as large as he appears to be at mid-day. In these circumstances he saw very distinctly the shadows of the trees, which were 30 or 40 feet from the white wall, coloured with a light green inclining to blue. The shadow of an arbour, which was three feet from the wall, was exactly drawn upon it, and looked as if it had been newly painted with verdigrise. This appearance lasted near five minutes; after which it grew fainter, and vanished at the same time with the light of the sun.

225 Blue shadows observed by him. The next morning at sunrise, he went to observe other shadows, upon another white wall; but instead of finding them green as before, he observed that they were of the colour of lively indigo. The sky was serene, except a slight covering of yellowish vapours in the east; and the sun rose behind a hill, so that it was elevated above his horizon. In these circumstances, the blue shadows were only visible three minutes; after which they appeared black, and in the evening of the same day he observed the green shadows exactly as before. On another day at sunset he observed that the shadows were not green, but of a beautiful sky-blue. He also observed that the sky was in a great measure free from vapours at that time, and that the sun set behind a rock, so that it disappeared before it came to his horizon. Afterwards, he often observed the shadows both at sunrise and sunset; but always perceived them to be blue, though with a great variety of shades.

226 Explanation of these phenomena attempted by Abbé Mazeas. The first person who attempted to explain this phenomenon was the Abbé Mazeas. He observed that when an opaque body was illuminated by the moon and a candle at the same time, and the two shadows were cast upon the same white wall, that which was enlightened by the candle was reddish, and that which was enlightened by the moon was blue. He supposed, however, the change of colour to be occasioned by the diminution of the light;

227 Melville's and Bouguer's explanation. but M. Melville and M. Bouguer, both independent of one another, seem to have hit upon the true cause of this curious appearance, and which has been already hinted at. The former of these gentlemen, in his attempts to explain the blue colour of the sky, observes, that since it is certain that no body assumes any particular colour, but because it reflects one sort of rays more abundantly than the rest; and since it cannot be supposed that the constituent parts of pure air are gross enough to separate any colours of themselves; we must conclude with Sir Isaac Newton, that the violet and blue making rays are reflected more copiously than the rest, by the finer vapours diffused through the atmosphere, whose parts are not big enough to give them the appearance of visible opaque clouds. And he shows that in proper circumstances, the bluish colour of the sky light may be actually seen on bodies illuminated by it, as, he says, it is objected should always happen upon this hypothesis. For that if, on a cloudless day, a sheet of white paper be exposed to the sun's beams, when any opaque body is placed upon it, the shadow which is illuminated by the sky only will appear remarkably bluish compared with the rest of the paper, which receives the sun's direct rays.

M. Bouguer, who has taken the most pains with this subject, observes, that as M. Buffon mentions the shadows appearing green only twice, and that at all other times they were blue, this is the colour which they regularly have, and that the blue was changed into green by some accidental circumstance. Green, he says, is only a composition of blue and yellow, so that this accidental change may have arisen from the mixture of some yellow rays in the blue shadow; and that perhaps the walls might have had that tinge, so that the blue is the only colour for which a general reason is required. This, he says, must be derived from the colour of pure air, which always appears blue, and which always reflects that colour upon all objects without distinction; but which is too faint to be perceived when our eyes are strongly affected by the light of the sun, reflected from other objects around us.

To

Blue colour of the Sky.

To confirm this hypothesis, he adds some interesting observations of his own, in which this appearance is agreeably diversified. Being at the village of Boucholtz in July 1764, he observed the shadows projected on the white paper of his pocket-book when the sky was clear.

228 Curious observations on this subject.

At half an hour past six in the evening, when the sun was about 4° high, he observed that the shadow of his finger was of a dark gray, while he held the paper opposite to the sun; but when he inclined it almost horizontally, the paper had a bluish cast, and the shadow upon it was of a beautiful bright blue.

When his eye was placed between the sun and the paper laid horizontally, it always appeared of a bluish cast; but when he held the paper thus inclined between his eye and the sun, he could distinguish, upon every little eminence occasioned by the inequality of the surface of the paper, the chief prismatic colours. This multitude of coloured points, red, yellow, green, and blue, almost effaced the natural colour of the objects.

At $6^{h}\ 45'$ the shadows began to be blue, even when the rays of the sun fell perpendicularly. The colour was the most lively when the rays fell upon it at an angle of 45°; but with a less inclination of the paper, he could distinctly perceive, that the blue shadow had a border of a stronger blue on that side which looked towards the sky, and a red border on that side which was turned towards the earth. To see these borders, it was necessary to place the body that made the shadow very near the paper; and the nearer it was, the more sensible was the red border. At the distance of three inches, the whole shadow was blue. At every observation, after having held the paper towards the sky, he turned it towards the earth, which was covered with verdure; holding it in such a manner, that the sun might shine upon it while it received the shadows of various bodies; but in this position he could never perceive the shadow to be blue or green at any inclination with respect to the sun's rays.

At seven o'clock, the altitude of the sun being still about two degrees, the shadows were of a bright blue, even when the rays fell perpendicularly upon the paper, but were brightest when it was inclined 45°. At this time he was surprised to observe, that a large tract of sky was not favourable to the production of this blue colour, and that the shadow falling upon the paper placed horizontally was not coloured, or at least the blue was very faint. This singularity, he concluded, arose from the small difference between the light of that part of the paper which received the rays of the sun and that which was in the shade in this situation. In a situation precisely horizontal, the difference would vanish, and there could be no shadow. Thus too much or too little of the sun's light produced, but for different reasons, the same effect; for they both made the blue light reflected from the sky become insensible. This gentleman never saw any green shadows; but supposes that the cause of those seen by Buffon might be the mixture of yellow rays, reflected from the vapours, which he observes were of that colour.

229 Blue shadows not confined to the mornings and evenings.

These blue shadows, our author observes, are not confined to the times of the sunrising and sunsetting; on the 19th of July, when the sun has the greatest force, he observed them at three o'clock in the afternoon, but the sun at that time shone through a mist.

If the sky be clear the shadows begin to be blue, when, if they be projected horizontally, they are eight times as long as the height of the body that produces them, that is, when the altitude of the sun's centre is $7^{\circ}\ 8'$. This observation, he says, was made in the beginning of August.

Besides these coloured shadows, which are produced by the interception of the direct rays of the sun, our author observed others similar to them at every hour of the day, in rooms into which the light of the sun was reflected from some white body, if any part of the clear sky could be seen from the place, and all unnecessary light was excluded as much as possible. He remarks, that the blue shadows may be seen at any hour of the day, even with the direct light of the sun; and that this colour will disappear in all those places of the shadow from which the blue sky cannot be seen.

All the observations that our author made upon the yellow or reddish borders of shadows above mentioned, led him to conclude, that they were occasioned by the interception of the sky light, whereby part of the shadow was illuminated either by the red rays reflected from the clouds when the sun is near the horizon, or from some terrestrial bodies in the neighbourhood. This conjecture is favoured by the necessity he was under of placing any body near the paper, in order to produce this bordered shadow, as he says it is easily demonstrated, that the interception of the sky light can only take place when the breadth of the opaque body is to its distance from the white ground on which the shadow falls, as twice the line of half the amplitude of the sky to its cosine.

230 Another kind of shadows.

At the conclusion of his observations on these blue shadows, he gives a short account of another kind of them, which he supposes to have the same origin. These he often saw early in the spring when reading by the light of a candle in the morning, and consequently with the twilight mixed with that of his candle. In these circumstances, the shadow made by intercepting the light of his candle, at the distance of about six feet, was of a beautiful and clear blue, which became deeper as the opaque body which made the shadow was brought nearer to the wall, and was exceedingly deep at the distance of a few inches only. But where the day light did not come, the shadows were all black without the least mixture of blue.

231 New explanation of the colour of the sky.

The explanations of the blue colour of the sky given by Newton and Bouguer are far from satisfactory, and we presume that the following method of accounting for that phenomenon affords the true explanation. The light which flows from any portion of the blue sky is obviously reflected light, which is thrown out into the atmosphere in all directions by the earth, and the clouds and vapours which surround it. The red or least refrangible rays of this light having a greater momentum than the blue or most refrangible rays, penetrate much farther into the atmosphere, and though a few may be reflected, yet almost all of them will be absorbed or lost before they can return to the earth's surface. On the contrary, the blue rays, having less momentum, are not capable of penetrating so far into a resisting medium, and are therefore reflected to the earth's surface, and give a blue colour to the expanse of the heavens. The blue colour of the sky is exactly the converse of the red colour which is perceived at great depths in the sea, and of the red hue of the morning and evening clouds. These phenomena

Irradiations of the Sun's Light, &c. phenomena being produced by transmitted or refracted light; the red rays make their way through the medium to the observer's eye, while the blue ones are reflected or absorbed.

Sect. V. *Of the Irradiations of the Sun's Light appearing through the interstices of the Clouds.*

This is an appearance which every one must have observed when the sky was pretty much overcast, and the clouds have many breaks or openings. At that time several large beams of light, something like the appearance of the light of the sun admitted into a smoky room, will be seen generally with a very considerable degree of divergency, as if the radiant point was situated at no great distance above the clouds. Dr Smith observes that this appearance is one of those which serve to demonstrate that very high and remote objects in the heavens do not appear to us in their real shapes and positions, but according to their perspective projections in the apparent concavity of the sky. He acquaints us, that though these beams are generally seen diverging, as represented in fig. 11. it is not always the case. He himself, in particular, once saw them converging towards a point diametrically opposite to the sun: for, as near as he could conjecture, the point to which they converged was situated as much below the horizon as the sun was then elevated above the opposite part of it. This part is represented by the line t D t, and the point below it in opposition to the sun is E; towards which all the beams $v\,t$, $v\,t$, &c. appeared to converge.

Plate CCLXXXIV. fig. 11.

232 Converging irradiations observed by Dr Smith. Fig. 21.

233 The phenomenon explained by him.

Perceiving that the point of convergency was opposite to the sun, he suspected that this unusual phenomenon was but a case of the usual *apparent divergence* of the beams of the sun from his apparent place among the clouds, as represented in fig. 11.; for though nothing is more common than for rays to diverge from a luminous body, yet the divergence of these beams in such large angles is not real, but apparent. Because it is impossible for the direct rays of the sun to cross one another at any point of the apparent concavity of the sky, in a greater angle than about half a degree. For the diameter of the earth being so very small, in comparison to the distance of the sun, as to subtend an angle at any point of his body of about 20 seconds; and the diameter of our visible horizon being extremely smaller than that of the earth; it is evident, that all the rays which fall upon the horizon from any given point of the sun, must be inclined to each other in the smallest angles imaginable: the greatest of them being as much smaller than that angle of 20″ as the diameter of the visible horizon is smaller than that of the earth. All the rays that come to us from any given point of the sun may therefore be considered as parallel; as the rays e B g from the point e, or f B h from the opposite point f; and consequently the rays of these two pencils that come from opposite points of the sun's real diameter, and cross each other in the sun's apparent place B among the clouds, can form no greater an angle with each other than about half a degree; this angle of their intersection e B f being the same as the sun would subtend to an eye placed among the clouds at B, or (which is much the same) to an eye at O upon the ground. Because the sun's real distance OS is inconceivably greater than his apparent distance OB. Therefore the rays of the sun, as B g, B h, do really diverge from his apparent place B in no greater angles g B h than about half a degree. Nevertheless they appear to diverge from the place B in all possible angles, and even in opposite directions. Let us proceed then to an explanation of this apparent divergence, which is by no means self-evident; though at first sight we are apt to think it is, by not distinguishing the vast difference between the true and apparent distances of the sun.

Fig. 13.

Supposing all the rays of the sun to fall accurately parallel to each other upon the visible horizon, as they do very nearly, yet in both cases they must appear to diverge in all possible angles. Let us imagine the heavens to be partly overcast with a spacious stratum of broken clouds, v, v, v, &c. parallel to the plane of the visible horizon, represented by the line AOD; and when the sun's rays fall upon these clouds in the parallel lines $s\,v$, $s\,v$, &c. let some of them pass through their interstices in the lines $v\,t$, $v\,t$, &c. and fall upon the plane of the horizon at the places t, t, &c. And since the rest of the incident rays $s\,v$, $s\,v$, are supposed to be intercepted from the place of the spectator at O by the cloud x, and from the intervals between the transmitted rays $v\,t$, $v\,t$, &c. by the clouds v, v, &c. a small part of these latter rays $v\,t$, $v\,t$, when reflected every way from some certain kind of thin vapours floating in the air, may undoubtedly be sufficient to affect the eye with an appearance of lights and shades, in the form of bright beams in the places $v\,t$, $v\,t$, &c. and of dark ones in the intervals between them; just as similar beams of light and shade appear in a room by reflections of the sun's rays from smoke or dust flying within it; the lights and shades being here occasioned by the transmission of the rays through some parts of the window, and by their interruption at other parts.

Fig. 14.

Now, if the apparent concavity of this stratum of clouds v, v, to the eye at O, be represented by the arch ABCD, and be cut in the point B by the line OBx parallel to the beams $t\,v$; it will be evident by the rules of perspective, that these long beams will not appear in their real places, but upon the concave AB CD diverging every way from the place B, where the sun himself appears, or the cloud x that covers his body, as represented separately in full view in fig. 11. Fig. 11.

And for the same reason, if the line BO be produced towards E, below the plane of the horizon AOD, and the eye be directed towards the region of the sky directly above E, the lower ends of the same real beams $v\,t$, $v\,t$, will now appear upon the part DF of this concave; and will seem to converge towards the point E, situated just as much below the horizon as the opposite point B is above it: which is separately represented in full view in fig. 12. Fig. 12.

For if the beams $v\,t$, $v\,t$, be supposed to be visible throughout their whole lengths, and the eye be directed in a plane perpendicular to them, here represented by the line OF; they and their intervals will appear broadest in and about this plane, because these parts of them are nearest to the eye; and therefore their remoter parts and intervals will appear gradually narrower towards the opposite ends of the line BE. As a farther illustration of this subject, we may conceive the spectator at O to be situated upon the top of so large a descent OHI towards a remote valley IK, and the sun to be so very low, that the point E, opposite to him, may be seen above the horizon of this shady valley.

Irradiations of the Sun's Light, &c.

ley. In this case it is manifest, that the spectators at O would now see these beams converging so far as to meet each other at the point E in the sky itself.

234 Not observed by moon-light.

This phenomenon is not seen in moonlight, probably because her light is too weak after reflections from any kind of vapours, to cause a sensible appearance of lights and shades so as to form these beams. And in the phenomenon of fig. 12. the converging sunbeams towards the point below the horizon were not quite so bright and strong as those usually are that diverge from him; and the sky beyond them appeared very black (several showers having passed that way), which certainly contributed to this appearance. Hence it is probable that the thinness and weakness of the reflected rays from the vapours opposite the sun, is the chief cause that this appearance is so very uncommon in comparison to that of diverging beams. For as the region of the sky round about the sun is always brighter than the opposite one, so the light of the diverging beams ought also to be brighter than that of the converging ones. For, though rays are reflected from rough unpolished bodies in all directions, yet more of them are reflected forwards obliquely, than are reflected more directly backwards. Besides, in the present case, the incident rays upon the opposite region to the sun, are more diminished by continual reflections from a longer tract of the atmosphere, than the incident rays upon the region next the sun.

235 The phenomenon of diverging beams more frequent in summer than in winter.

The common phenomenon of diverging beams is more frequent in summer than in winter, and also when the sun is lower than when higher up; probably because the lower vapours are denser, and therefore more strongly reflective than the higher; because the lower sky light is not so bright as the upper; because the air is generally more quiet in the mornings and evenings than about noon-day; and lastly, because many sorts of vapours are more plentifully exhaled in summer than in winter, from many kinds of volatile vegetables; which vapours, when the air is cooled and condensed in the mornings and evenings, may become dense enough to reflect a sensible light.

Sect. VI. *Of the Illumination of the Earth's Shadow in Lunar Eclipses.*

The ancient philosophers, who knew nothing of the refractive power of the atmosphere, were much perplexed to account for the body of the moon being visible when totally eclipsed. At such times she generally appears of a dull red colour, like tarnished copper. This,

236 Why the moon is visible when totally eclipsed.

they thought, was the moon's native light, by which she became visible when hid from the brighter light of the sun. Plutarch, indeed, attributes this appearance to the light of the fixed stars reflected to us by the moon; but this is too weak to produce the effect. The true cause of it is the scattered beams of the sun bent into the earth's shadow by refractions through the atmosphere in the following manner.

Plate CCLXXXV. fig. 1.

Let the body of the sun be represented by the circle ab, and that of the earth by cd; and let the lines ace and bde touch them both, and meet in e beyond the earth; then the angular space ced will represent the conical figure of the earth's shadow, which would be totally dark, were none of them bent into it by the refraction of the atmosphere. The rays ah and bi, which touch its opposite sides, will proceed unrefracted, and meet each other at k. Then the two nearest rays

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to these that flow within them, from the same points a and b, being refracted inwards through the margin of the atmosphere, will cross each other at a point l, somewhat nearer to the earth than k; and in like manner, two opposite rays next within the two last will cross each other at a point m, somewhat nearer to the earth than l, having suffered greater refractions, by passing through longer and denser tracts of air lying somewhat nearer to the earth. The like approach of the successive intersections k, l, m, is to be understood of innumerable couples of rays, till you come to the intersection n of the two innermost; which we may suppose just to touch the earth at the points o and p. It is plain then, that the space bounded by these rays on, np, will be the only part of the earth's shadow wholly unenlightened. Let fmg be part of the moon's orbit when it is nearest the earth, at a time when the earth's dark shadow onp, is longest: in this case, the ratio of tm to tn is about 4 to 3; and consequently the moon, though centrally eclipsed at m, may yet be visible by means of the scattered rays, first transmitted to the moon by refraction through the atmosphere, and thence reflected to the earth.

Fig. 2.

For let the incident and emergent parts aq, rn, of the ray $aqorn$, that just touches the earth at o, be produced till they meet at u, and let aqu produced meet the axis st produced in x; and joining us and um, since the refractions of a horizontal ray passing from o to r, or from o to q, would be alike and equal, the external angle nux is double the quantity of the usual refraction of a horizontal ray; and the angle aus is the apparent measure of the sun's semidiameter seen from the earth; and the angle ust is that of the earth's semidiameter tu seen from the sun (called his *horizontal parallax*); and lastly, the angle umt is that of the earth's semidiameter seen from the moon (called her *horizontal parallax*); because the elevation of the point u above the earth is too small to make a sensible error in the quantity of these angles; whose measures by astronomical tables are as follow:

		′	″	
Sun's least app. semidiam.	$= aus =$	15	50	
Sun's horizontal parallax	$= ust =$	00	10	
Their difference * is	$= txu =$	15	40	* Eucl. I. Prop. xxxii.
Twice horizontal refraction	$= nux =$	67	30	
Their sum † is	$= tnu =$	83	10	† Ibid.
Moon's greatest horiz. parallax	$= tmu =$	62	10	

Therefore (by a preceding prop.) we have $tm : tn =$ (ang. tnu : ang. $tmu = 83'—10'' : 62'—10'' =$) $4 : 3$ in round numbers; which was to be proved. It is easy to collect from the moon's greatest horizontal parallax of $62'—10''$, that her least distance tm is about $55\frac{1}{7}$ semidiameters of the earth; and therefore the greatest length tn of the dark shadow, being three quarters of tm, is about $41\frac{1}{3}$ semidiameters.

The difference of the last-mentioned angles tnu, tmu is $mun = 21'$, that is, about two-thirds of $31'—40''$, the angle which the whole diameter of the sun subtends at u. Whence it follows, that the middle point m of the moon centrally eclipsed, is illuminated by rays which come from two-thirds of every diameter of the sun's disk, and pass by one side of the earth; and also by rays that come from the opposite two-thirds of

every

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every one of the said diameters, and pass by the other side of the earth. This will appear by conceiving the ray *a q o r n* to be inflexible, and its middle point *a* to slide upon the earth, while the part *r n* is approaching to touch the point *m*; for then the opposite part *q a* will trace over two thirds of the sun's diameter. The true proportion of the angles *n u m*, *a u s*, could not be preserved in the scheme, by reason of the sun's immense distance and magnitude with respect to the earth.

Fig. 3. Having drawn the line *a t α*, it may be observed, that all the incident rays, as *a q*, *α x*, flowing from any one point of the sun to the circumference of the earth, will be collected to a focus *α*, whose distance *t α* is less than *t m* in the ratio of 62 to 67 nearly; and thus an image of the sun will be formed at *α β*, whose rays will diverge upon the moon. For the angle *t α u* is the difference of the angles *x u α*, *u α t* found above; and $t\alpha : tm =$ ang. tmu : ang. $t\alpha u = 62'—10'' : 67—30''$.

The rays that flow next above *a q* and *α x*, by passing through a rarer part of the atmosphere, will be united at a point in the axis *a t α* farther from the earth than the last focus *α*; and the same may be said of the rays that pass next above these, and so on; whereby an infinite series of images of the sun will be formed, whose diameters and degrees of brightness will increase with their distances from the earth.

Hence it is manifest why the moon eclipsed in her perigee appears always duller and darker than in her apogee. The reason why her colour is always of the copper kind, between a dull red and orange, seems to be this: The blue colour of a clear sky shows that the blue rays are more copiously reflected from pure air than those of any other colour; consequently they are less copiously transmitted through it among the rest that come from the sun, and so much the less as the tract of air through which they pass is the longer. Hence the common colour of the sun and moon is whitest in the meridian, and grows gradually more inclined to diluted yellow, orange, and red, as they descend lower, that is, as the rays are transmitted through a longer tract of air; which tract being still lengthened in passing to the moon and back again, causes a still greater loss of the blue rays in proportion to the rest; and so the resulting colour of the transmitted rays must lie between a dark orange and red, according to Sir Isaac Newton's rule for finding the result of a mixture of colours. The circular edge of the shadow in a partial eclipse appears red; because the red-making rays are the least refracted of all others, and consequently are left alone in the conical surface of the shadow, all the rest being refracted into it.

237 Why the moon appears duller when eclipsed in her perigee than in her apogee.

Dr Herschel, who believes that the moon is phosphorescent, and that she shines by her native light, when totally eclipsed by the sun, has endeavoured to shew, by calculation, that the light refracted by the atmosphere cannot in some cases fall upon the moon.

PART III. ON THE CONSTRUCTION OF OPTICAL INSTRUMENTS.

Chap. I. *Description of Optical Instruments.*

OF the mechanism of optical instruments, particular accounts are given in this work under their respective names. These it would be improper to repeat; but as it belongs to the science of optics to explain, by the laws of refraction and reflection, the several phenomena which those instruments exhibit, we must here enumerate the instruments themselves, omitting entirely, or stating very briefly, such facts as are given at large in other places.

Sect. I. *The Multiplying Glass.*

Plate cclxxxvi. fig. 1.

238 Multiplying glass.

The multiplying glass is made by grinding down the convex side *h i k* of a plano-convex glass AB, into several flat surfaces, as *h b*, *b l d*, *d k*. An object C will not appear magnified when seen through this glass by the eye at H; but it will appear multiplied into as many different objects as the glass contains plane surfaces. For, since rays will flow from the object C to all parts of the glass, and each plane surface will refract these rays to the eye, the same object will appear to the eye in the direction of the rays which enter it through each surface. Thus, a ray *g i* H, falling perpendicularly on the middle surface, will go through the glass to the eye without suffering any refraction; and will therefore show the object in its true place at C: whilst a ray *a b* flowing from the same object, and falling obliquely on the plane surface *b h*, will be refracted in the direction *b e*, by passing through the glass; and, upon leaving it, will go on to the eye in the direction *e* H; which will make the same object C appear also at E, in the direction of the ray H *e*, produced in the right line H *e n*. And the ray *c d*, flowing from the object C, and falling obliquely on the plane surface *d k*, will in the same way be refracted to the eye at H; which will cause the same object to appear at D, in the direction H *f m*.—If the glass be turned round the line *g l* H, as an axis, the object C will keep its place, because the surface *b l d* is not removed; but all the other objects will seem to go round C, because the oblique planes, on which the rays *a b c d* fall, will turn round by the motion of the glass.

Sect. II. *Mirrors.*

It has been already observed, that there are three kinds of mirrors principally used in optical experiments (see Catoptrics, Sect. I.); the plane mirror, the spherical convex mirror, and the spherical concave mirror. Of these the plane mirror first claims our attention, as it is more common, and of greater antiquity, than the other two. We have shewn that the image reflected by this mirror appears as far behind the surface as the object is before it; that the image will appear of the same size and in the same position with the object; that every plane mirror will reflect an image of twice its own length and breadth; and that in certain circumstances it will reflect several images of the same object. These phenomena we shall now explain by the laws of reflection.

Plate cclxxxvii. fig. 2.

Let AB be an object placed before the reflecting surface *g h i* of the plane mirror CD; and let the eye be at *o*. Let A *h* be a ray of light flowing from the top A of the object, and falling upon the mirror at *h*, and *h m* be a perpendicular to the surface of the mirror at *h*; the ray A *h* will be reflected from the mirror to the eye at *o*, making an angle *m h o* equal to the angle

Optical Instruments.

A hm: then will the top of the image E appear to the eye in the direction of the reflected ray oh produced to E, where the right line ApE, from the top of the object, cuts the right line ohE, at E. Let Bi be a ray of light issuing from the foot of the object at B to the mirror at i; and ni a perpendicular to the mirror from the point i, where the ray Bi falls upon it; this ray will be reflected in the line io, making an angle nio equal to the angle Bin, with that perpendicular, and entering the eye at o; then will the foot F of the image appear in the direction of the reflected ray oi, produced to F, where the right line BF cuts the reflected ray produced to F. All the other rays that flow from the intermediate points of the object AB, and fall upon the mirror between h and i, will be reflected to the eye at o; and all the intermediate points of the image EF will appear to the eye in the direction of these reflected rays produced. But all the rays that proceed from the object and fall upon the mirror above h, will be reflected back above the eye at o; and all the rays that flow from the object, and fall upon the mirror below i, will be reflected back below the eye at o; so that none of the rays that fall above h, or below i, can be reflected to the eye at o; and the distance between h and i is equal to half the length of the object AB.

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Size of a looking-glass in which a man may see his whole image.

Hence it appears, that if a man sees his whole image in a plane looking-glass, the part of the glass that reflects his image must be just half as long and half as broad as himself, let him stand at any distance from it whatever; and that his image must appear just as far behind the glass as he is before it. Thus, the man AB viewing himself in the plane mirror CD, which is just half as long as himself, sees his whole image as at EF, behind the glass, exactly equal to his own size. For a ray AC proceeding from his eye at A, and falling perpendicularly upon the surface of the glass at C, is reflected back to his eye, in the same line CA; and the eye of his image will appear at E, in the same line produced to E, beyond the glass. And a ray BD, flowing from his foot, and falling obliquely on the glass at D, will be reflected as obliquely on the other side of the perpendicular abD, in the direction DA; and the foot of his image will appear at F, in the direction of the reflected ray AD, produced to F, where it is cut by the right line BGF, drawn parallel to the right line ACE; just the same as if the glass were taken away, and the real man stood at F, equal in size to the man standing at B: For to his eye at A, the eye of the other man at E would be seen in the direction of the line ACE; and the foot of the man at F would be seen by the eye A, in the direction of the line ADF. (Fig. 3.)

If the glass be brought nearer the man AB, suppose to cb, he will see his image at CDG: for the reflected ray CA (being perpendicular to the glass) will show the eye of the image at C; and the incident ray Bb, being reflected in the line bA, will show the foot of his image at G; the angle of reflection abA being always equal to the angle of incidence Bba; and so of all the intermediate rays from A to B. Hence, if the man AB advances towards the glass CD, his image will approach towards it; and if he recedes from the glass, his image will also recede from it.

If the object be placed before a common looking-glass, and viewed obliquely, three, four, or more images of it, will appear behind the glass.

To explain this, let ABCD represent the glass; and let EF be the axis of a pencil of rays flowing from E, a point in an object situated there. The rays of this pencil will in part be reflected at F, suppose into the line FG. What remains will (after refraction at F, which we do not consider here) pass on to H; from whence (on account of the quicksilver which is spread over the second surface of the glass) they will be strongly reflected to K, where part of them will emerge and enter an eye at L. By this means one representation of the point E will be formed in the line LK produced, suppose in M: Again, Another pencil, whose axis is EN, first reflected at N, then at O, and afterwards at P, will form a second representation of the same point at Q: And, thirdly, Another pencil, whose axis is ER, after successive reflections at the several points R, S, H, T V, will exhibit a third representation of the same point at X; and so on *ad infinitum*. The same being true of each point in the object, the whole will be represented in the like manner; but the representations will be faint, in proportion to the number of reflections which the rays suffer, and the length of their progress within the glass. We may add to these another representation of the same object in the line LO produced, made by such of the rays as fall upon O, and are thence reflected to the eye at L. This experiment may be tried by placing a candle before the glass as at E, and viewing it obliquely, as from L.

Plate CCLXXXII. fig. 11.

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Why three or four images of objects are seen in plane mirrors.

2. *Of Concave Mirrors.* The effects of these in magnifying and diminishing objects, have in general been already explained; but in order to understand the nature of reflecting telescopes, it will still be proper to subjoin the following particular description of the effects of concave mirrors.

Plate CCLXXXVII. fig. 4.

When parallel rays, as dfa, Cmb, ebc, fall upon a concave mirror AbB, they will be reflected back from that mirror, and meet in a point m, at half the distance of the surface of the mirror from C the centre of its concavity; for they will be reflected at as great an angle from a perpendicular to the surface of the mirror, as they fell upon it with regard to that perpendicular, but on the other side thereof. Thus, let C be the centre of concavity of the mirror AbB; and let the parallel rays dfa, Cmb, and elc, fall upon it at the points a, b, and c. Draw the lines Cia, Cmb, and Chc, from the centre C to these points; and all these lines will be perpendicular to the surface of the mirror. Make the angle Cah=daC, and draw the line amh, which will be the direction of the ray dfa, after it is reflected from the point a of the mirror; so that the angle of incidence daC=Cah, the angle of reflection; the rays making equal angles with the perpendicular Cia on its opposite sides.

Draw also the perpendicular Chc to the point c, where the ray elc touches the mirror; and having made the angle Cci=Cce, draw the line cmi, which will be the course of the ray elc, after it is reflected from the mirror. The ray Cmb passing through the centre of concavity of the mirror, and falling upon it at b, is perpendicular to it; and is therefore reflected back from it in the same line bmC. All these reflected rays meet in the point m; and in that point the image of the body which emits the parallel rays da, Cb, and ec, will be formed; which point is distant from the mirror equal to half the radius bmC of its concavity.

As

As the rays which proceed from any celestial object may be esteemed parallel, the image of that object will be formed at *m*, when the reflecting surface of the concave mirror is turned directly to the object. Hence the focus *m* of parallel rays is not in the centre of the mirror's concavity, but half way between the mirror and that centre.

The rays which proceed from any remote terrestrial object are not strictly parallel, but come diverging to it, in separate pencils, from each point of the side of the object next the mirror; and therefore they will not be converged to a point at the distance of half the radius of the mirror's concavity from it's reflecting surface, but into separate points at a little greater distance from the mirror. The nearer the object is to the mirror, the farther these points will be from it: and an inverted image of the object will be formed in them, which will seem to hang in the air, and will be seen by an eye placed beyond it (with regard to the mirror) in all respects similar to the object, and as distinct as the object itself.

241 Aerial images formed by concave mirrors. Fig. 5.

Let A *c* B be the reflecting surface of a mirror, whose centre of concavity is at C; and let the upright object DE be placed beyond the centre C, and send out a conical pencil of diverging rays from its upper extremity D, to every point of the concave surface of the mirror A *c* B. But to avoid confusion, we only draw three rays of that pencil, as D A, D *c*, D B.

From the centre of concavity C, draw the three right lines C A, C *c*, CB, touching the mirror in the same points where the three rays touch it; and all these lines will be perpendicular to the surface of the mirror. Make CA *d*=DAC, and draw the right line A *d* for the course of the reflected ray DA: make C *c d*=D *c* C, and draw the right line *c d* for the course of the reflected ray D *d*: make also CB *d*=DBC, and draw the right line B *d* for the course of the reflected ray DB. All these reflected rays will meet in the point *d*, where they will form the extremity *d* of the inverted image *e d* similar to the extremity D of the upright object DE.

If the pencil of rays E *f*, E *g*, E *h*, be also continued to the mirror, and their angles of reflection from it be made equal to their angles of incidence upon it, as in the former pencil from D, they will all meet at the point *e* by reflection, and form the extremity *e* of the image *e d*, similar to the extremity E of the object DE. And as each intermediate point of the object, between D and E, sends out a pencil of rays in like manner to every part of the mirror, the rays of each pencil will be reflected back from it, and meet in all the intermediate points between the extremities *e* and *d* of the image; and so the whole image will be formed in an inverted position not at *i*, half the distance of the mirror from its centre of concavity C, but at a greater distance between *i* and the object DE.

This being well understood, the reader will easily understand how the image is formed by the large concave mirror of the reflecting telescope, when he comes to the description of that instrument.

When the object is more remote from the mirror than its centre of concavity C, the image will be less than the object, and between the object and mirror: when the object is nearer than the centre of concavity, the image will be more remote and bigger than the object. Thus, if ED be the object, *d e* will be its image: For as the object recedes from the mirror, the image approaches nearer to it; and as the object approaches nearer to the mirror, the image recedes farther from it; on account of the lesser or greater divergency of the pencil of rays which proceed from the object: for the less they diverge, the sooner they are converged to points by reflection; and the more they diverge, the farther they proceed before they meet.

If the radius of the mirror's concavity, and the distance of the object after refraction, be known, the distance of the image from the mirror is found by this rule: Divide the product of the distance and radius by double the distance made less by the radius, and the quotient is the distance required.

If the object be in the centre of the mirror's concavity, the image and object will be coincident, and equal in bulk.

If a man place himself directly before a large concave mirror, but farther from it than its centre of concavity, he will see an inverted image of himself in the air, between him and the mirror, and of a less size than himself. If he holds out his hand towards the mirror, the hand of the image will come out towards his hand, and coincide with it, of an equal bulk, when his hand is in the centre of concavity; and he will imagine he may shake hands with his image. If he reaches his hand farther, the hand of the image will pass by his hand, and come between his hand and his body: and if he moves his hand towards either side, the hand of the image will move towards the other; so that whatever way the object moves, the image will move the contrary. All the while a bystander will see nothing of the image, because none of the reflected rays that form it enter his eyes.

Sect. III. *Camera Obscura*.

The camera obscura having already been fully described under the word Dioptrics, we shall at present only direct the readers attention to an improvement which has lately been made upon this amusing instrument.

" The improvements (says Dr Brewster) which have been made upon the camera obscura since its first invention, regard chiefly its external form; and no attempts have been made to increase the brilliancy and distinctness of the image. When we compare the picture of external objects, which is formed in a dark chamber by the object-glass of a common refracting telescope, with that which is formed with an achromatic object-glass, we shall find the difference between their distinctness much less than we should have at first expected. Although the achromatic lens form an image of the minutest parts of the landscape, yet when this image is received on paper, these minute parts are obliterated by the small hairs and asperities on its surface, and the effect of the picture is very much impaired. In the Royal Observatory at Greenwich the image is received upon a large concave piece of stucco; but this substance does not seem to be more favourable for the reception of images than a paper ground. In order to obviate these imperfections, I tried a number of white substances of different degrees of smoothness, and several metallic surfaces with different degrees of polish, but did not succeed in finding any surface superior to paper. I happened, however, to receive the image on the silvered back of a looking-glass, and was surprised at the brilliancy and distinctness with which external objects were represented. The little spherical protuberances, however,

ever, which arise from the roughness of the tinfoil, have a tendency to detract from the precision of the image, and certainly injure it considerably when examined narrowly with the eye. In order to remove these small eminences, I ground the surface carefully with a bed of hones which I had used for working the plane specula of Newtonian telescopes. By this operation, which is exceedingly delicate, and may be performed without injuring the mirror, I obtained a surface finely adapted for the reception of images. The minute parts of the landscape, when received on this substance, are formed with so much precision, and the brilliance of the colouring is so uncommonly fine, as to equal, if not surpass the images formed in the air by means of concave specula. Notwithstanding the bluish colour of the metallic ground, white objects are represented in their true colour, and the verdure of the foliage is so rich and vivid, that the image seems to surpass in beauty even the object itself. On account of the metallic lustre of the surface, the distinctness of the image will always be greatest when the eye of the observer is placed in the direction of the inflected rays.

"The common portable camera obscura, which has already been described (see DIOPTRICS), is necessarily on a small scale, and has many disadvantages. These disadvantages are completely remedied in the camera obscura, invented by the Rev. Mr Thomson of Duddingston, which is represented in figures 1. and 2. of Plate CCCLXXXIX. In fig. 1. A is a metallic or wooden ring, in which the four wooden bars AF, AI, AG, AH, move by means of joints at A, and are kept asunder by the cross pieces BC, DE, which move round B and D as centres, and fold up along BA and DA, when the instrument is not used. The surface FIGH, on which the image is received, consists of a piece of silk covered with paper. It is made to roll up at IH, which moves in a joint at I, so that the whole surface FIHG, when winded upon IH, can be folded upon the bar IA. By this means the instrument, which is covered with green silk covered with a black substance, may be put together and carried as an umbrella. It is shewn more fully in fig. 2. where A is the aperture for placing the lens, and BC a semicircular opening for viewing the image. A black veil may be fixed to the circumference of BC, and thrown over the head of the observer to prevent the admission of any extraneous light."

Plate CCCLXXXIX. figs. 1, 2.

SECT. IV. *Microscopes.*

Under the article MICROSCOPE a full account has been given of the external construction of those instruments as they are now made by the most eminent artists.

It did not fall within the plan of that article to explain the way in which an enlarged picture of the object is formed upon the retina by means of the microscope, and the means of ascertaining its magnifying power; but we shall now direct the readers attention to this interesting subject.

1. *The Single Microscope*, the simplest of all microscopes is nothing more than a small globule of glass, or a convex lens whose focal distance is extremely short. The magnifying power of this microscope is thus ascertained by Dr Smith, "A minute object $p\,q$, seen distinctly through a small glass AE by the eye put close to it, appears so much greater than it would to the naked eye, placed at the least distance q L from whence it appears sufficiently distinct, as this latter distance q L is greater than the former q E. For having put your eye close to the glass EA, in order to see as much of the object as possible at one view, remove the object $p\,q$ to and fro till it appear more distinctly, suppose at the distance E q. Then conceiving the glass AE to be removed, and a thin plate, with a pin-hole in it, to be put in its place, the object will appear distinct and as large as before, when seen through the glass, only not so bright. And in this latter case it appears so much greater than it does to the naked eye at the distance q L, either with a pin-hole or without it, as the angle p E q is greater than the angle p L q, or as the latter distance q L is greater than the former q E. Since the interposition of the glass has no other effect than to render the appearance distinct, by helping the eye to increase the refraction of the rays in each pencil, it is plain that the greater apparent magnitude is entirely owing to a nearer view than could be taken by the naked eye. As the human eye is so constructed, as, for reasons already assigned, to have distinct vision only when the rays which fall upon it are parallel or nearly so; it follows that if the eye be so perfect as to see distinctly by pencils of parallel rays falling upon it, the distance E q, of the object from the glass, is then the focal distance of the glass. Now, if the glass be a small round globule, of about $\frac{1}{15}$th of an inch diameter, its focal distance E q, being three quarters of its diameter, is $\frac{1}{20}$th of an inch; and if q L be eight inches, the distance at which we usually view minute objects, this globule will magnify in the proportion of 8 to $\frac{1}{20}$, or of 160 to 1.

Plate CCCLXXXIX. figs. 6, 7.

Mr Gray's *Water Microscope* is represented in Plate CCCLXXXIX. fig. 4. The drop of water taken up on the point of a pin is introduced into the small hole D, $\frac{1}{10}$ of an inch in diameter, in the piece of brass DE, about $\frac{1}{10}$ of an inch thick. The hole D is in the middle of a spherical cavity, about $\frac{1}{8}$ of an inch in diameter, and a little deeper than half the thickness of the brass; on the opposite side of the brass is another spherical cavity, half as broad as the former, and so deep as to reduce the circumference of the small hole to a sharp edge. The water being placed in these cavties, will form a double convex lens with unequal convexities. The object, if it is solid, is fixed upon the point C of the supporter AB, and placed at its proper distance from the water lens by the screw FG. When the object is fluid, it is placed in the hole A, but in such a manner as not to be spherical; and this hole is brought opposite the fluid lens by moving the extremity G of the screw into the slit GH.

2. *The Double or Compound Microscope*, consists of an object-glass $c\,d$, and an eye-glass $e\,f$. The small object $a\,b$ is placed at a little greater distance from the glass $c\,d$ than its principal focus; so that the pencils of rays flowing from the different points of the object, and passing through the glass, may be made to converge, and unite in as many points between g and h, where the image of the object will be formed; which image is viewed by the eye through the eye-glass $e\,f$. For the eye-glass being so placed, that the image $g\,h$ may be in its focus, and the eye much about the same distance on the other side, the rays of each pencil will be parallel after going out of the eye-glass, as at e and f, till they come to the eye at k, where they will begin to converge by the refractive power of the humours; and after Fig. 8.

ter having crossed each other in the pupil, they will be collected into points on the retina, and form upon it the large inverted image AB.

242 Use of several lenses in a compound microscope.

By this combination of lenses, the aberration of the light from the figure of the glass, which in a globule of the kind above mentioned is very considerable, is in some measure corrected. This appeared so sensibly to be the case, even to former opticians, that they very soon began to make the addition of another lens. For, says Mr Martin, it is not only evident from the theory of this aberration, that the image of any point is rendered less confused by refraction through two lenses than by an equal refraction through one; but it also follows, from the same principle, that the same point has its image still less confused when formed by rays refracted through three lenses than by an equal refraction through two; and therefore a third lens added to the other will contribute to make the image more distinct, and consequently the instrument more complete. At the same time the field of view is amplified, and the use of the microscope rendered more agreeable, by the addition of the other lens. Thus also we may allow a somewhat larger aperture to the object lens, and thus increase the brightness of objects, and greatly heighten the pleasure of viewing them. For the same reason, Mr Martin has proposed a four-glass microscope, which answers the purposes of magnifying and of distinct vision still more perfectly.

Fig. 9.

The magnifying power of double microscopes is easily understood, thus: The glass L next the object PQ is very small, and very much convex, and consequently its focal distance LF is very short; the distance LQ of the small object PQ is but a little greater than LF: Greater it must be, that the rays flowing from the object may converge after passing through the glass, and crossing one another, form an image of the object; and it must be but a little greater, that the image $p\,q$ may be at a great distance from the glass, and consequently may be much larger than the object itself. This picture $p\,q$ being viewed through a convex glass AE, whose focal distance is q E, appears distinct as in a telescope. Now the object appears magnified for two reasons; first, because, if we viewed its picture $p\,q$ with the naked eye, it would appear as much greater than the object, at the same distance, as it really is greater than the object, or as much as L q is greater than LQ; and secondly, because this picture appears magnified through the eye-glass as much as the least distance at which it can be seen distinctly with the naked eye, is greater than q E, the focal distance of the eye-glass. If this latter ratio be five to one, and the former ratio of L q to LQ be 20 to 1; then, upon both accounts, the object will appear 5 times 20, or 100 times greater than to the naked eye.

Fig. 10.

The section of a compound microscope with three lenses is represented in fig. 10. By the middle one GK the pencil of rays coming from the object-glass are refracted so as to tend to a focus at O; but being intercepted by the proper eye-glass DF, they are brought together at I, which is nearer to that lens than its proper focus at L; so that the angle DIF, under which the object now appears, is larger than DLF, under which it would have appeared without this additional glass; and consequently the object is more magnified in the same proportion. Dr Hooke informs us, that, in most of his observations, he made use of a double microscope with this broad middle glass when he wanted to see much of an object at one view, and taking it out when he would examine the small parts of an object more accurately; for the fewer refractions there are, the more bright and clear the object appears.

243 Magnifying power of compound microscopes with three lenses.

The following rule for finding the magnifying power of compound microscopes with three lenses, has been given by Dr Brewster in his Appendix to Ferguson's Lectures, vol. ii. p. 468. "Divide the difference between the distance of the two first lenses, or those next the object, and the focal distance of the second or amplifying glass, by the focal distance of the second glass, and the quotient will be a first number. Square the distance between the two first lenses, and divide it by the difference between that distance, and the focal distance of the second glass, and divide this quotient by the focal distance of the third glass, or that next the eye, and a second number will be obtained. Multiply together the *first* and *second* numbers, and the magnifying power of the object glass (as found by one of the following tables), and the product will be the magnifying power of the compound microscope."

244 The magnifying power of Dr Smith's microscope.

Having in the historical part of this article given a short account of the construction of Dr Smith's double reflecting microscope, it may not be improper in this place to point out the method of ascertaining its magnifying power. This we shall do from the author himself, because his symbols, being general, are applicable to such microscopes of all dimensions.

Fig. 11.

Between the centre E and principal focus T of a concave speculum ABC, whose axis is EQTC, place an object PQ; and let the rays flowing from it be reflected from the speculum AB towards an image $p\,q$; but before they unite in it, let them be received by a convex speculum $a\,b\,c$, and thence be reflected, through a hole BC in the vertex of the concave, to a second image $\pi\,\kappa$, to be viewed through an eye-glass l.

The object may be situated between the specula C, c; or, which is better, between the principal focus t and vertex c of the convex one, a small hole being made in its vertex for the incident rays to pass through.

In both cases we have TQ, TE, T q, continual proportionals in some given ratio, suppose of 1 to n; and also $t\,q$, $t\,c$, $t\,\kappa$, continual proportionals in some other given ratio, suppose of 1 to m. Then if d be the usual distance at which we view minute objects distinctly with the naked eye, and $\kappa\,l$ the focal distance of the least eye-glass, through which the object appears sufficiently bright and distinct, it will be magnified in the ratio of $m\,n\,d$ to $\kappa\,l$.

For the object PQ, and its first image $p\,q$, are terminated on one side by the common axis of the specula, and on the other by a line PEp, drawn through the centre E of the concave ABC. Likewise the images $p\,q$ and $\pi\,\kappa$ are terminated by the common axis and by the line $e\,p\,\pi$, drawn through the centre e of the convex $a\,b\,c$ (Euclid, v. 12.). Hence, by the similar triangles $\pi\,\kappa\,e$, $p\,q\,e$, and also $p\,q$ E, PQE, we have $\pi\kappa : p\,q = \kappa\,e : q\,e = m : 1$, and $p\,q : \text{PQ} = q\,\text{E} : \text{QE} = n : 1$; and consequently $\pi\kappa : \text{PQ} = m\,n : 1$ whence $\pi\kappa = m\,n \times \text{PQ}$. Now if $l\,\kappa$ be the focal distance of the eye-glass l, the points P, Q of the object, are seen through it by the rays of two pencils emerging parallel to the lines

$\kappa\,l\,\kappa\,l$

Optical Instruments.

$\pi l \varkappa l$ respectively; that is, PQ appears under an angle equal to $\pi l \varkappa$, which is as $\frac{\pi\varkappa}{\varkappa l}=\frac{mn\text{PQ}}{\varkappa l}$; and to the naked eye at the distance d from PQ, it appears under an angle PoQ which is as $\frac{\text{PQ}}{d}$, and therefore is magnified in the ratio of these angles, that is, of $m\,n\,d$ to $\varkappa\,l$.

COR Having the numbers m, n, d, to find an eye-glass which shall cause the microscope to magnify M times in diameter, take $\varkappa\,l=\frac{m\,n\,d}{\text{M}}$. For the apparent magnitude is to the true as $\text{M}:1=m\,n\,d:\varkappa\,l$.

245 An easy method of ascertaining the magnifying power of the most common microscopes.

We shall conclude this part of our subject with the following easy method of ascertaining the magnifying power of such microscopes as are most in use.

The apparent magnitude of any object, as must appear from what has been already said, is measured by the angle under which it is seen; and this angle is greater or smaller according as the object is nearer to or farther from the eye; and of consequence the less the distance at which it can be viewed, the larger it will appear. The naked eye is unable to distinguish any object brought exceedingly near it: but by looking through a convex lens at an object placed in its focus, however near the focus of that lens be, an object may be distinctly seen; and the smaller the lens is, the nearer will be its focus, and in the same proportion the greater will be its magnifying power. From these principles it is easy to find the reason why the first or greatest magnifiers are so extremely minute; and also to calculate the magnifying power of any convex lens employed in a single microscope: For as the focal distance of the lens is to the distance at which we see objects distinctly with the naked eye, so is 1 to the magnifying power. If the focal length of a convex lens, for instance, be one inch, and the distance at which we look at small objects eight inches, which is the common standard, an object may be seen through that lens at one inch distance from the eye, and will appear in its diameter eight times larger than it does to the naked eye; but as the object is magnified every way, in length as well as in breadth, we must square this diameter to know how much it really is enlarged; and we then find that its superficies is magnified 64 times.

246 Further observations on the magnifying power of microscopes.

Again, Suppose a convex lens whose focal distance is only one-tenth of an inch; as in eight inches, the common distance of distinct vision with the naked eye, there are 80 tenths, an object may be seen through this glass 80 times nearer than with the naked eye. It will, of consequence, appear 80 times longer, and as much broader, than it does to common sight; and is therefore magnified 6400 times. If a convex glass be so small that its focus is only $\frac{1}{20}$th of an inch distant, we find that eight inches contain 160 of these twentieth parts; and consequently the length and breadth of any object seen through such a lens will be magnified 160 times, and the whole surface 25,600 times. As it is easy to melt a drop or globule of a much smaller diameter than a lens can be ground, and as the focus of a globule is no farther off than one-fourth of its own diameter, it must therefore magnify to a prodigious degree. But this excessive magnifying power is much more than counterbalanced by its admitting so little light, want of distinctness, and showing such a small portion of the object to be examined; for which reason, these globules, though greatly valued some time ago, are now almost entirely rejected. According to Mr Folkes's description of the single microscopes of convex lenses which Leeuwenhoek left to the Royal Society, they were all exceedingly clear, and showed the object very bright and distinct; which Mr Folkes considered as owing to the great care this gentleman took in the choice of his glass, his exactness in giving it the true figure, and afterwards reserving only such for his use as upon trial he found to be most excellent. Their powers of magnifying are different, as different objects may require: and as on the one hand, being all ground glasses, none of them are so small, or consequently magnify to so great a degree, as some of the globules frequently used in other microscopes; yet the distinctness of these very much exceeds those which are commonly used.

In order to find the magnifying power of a single microscope, no more is necessary than to bring it to its true focus, the exact place of which will be known by an object's appearing perfectly distinct and sharp when placed there. Then, with a pair of small compasses, measure, as nearly as possible, the distance from the centre of the glass to the object which is viewed, and how many parts of an inch that distance is. When this is known, compute how many times those parts of an inch are contained in eight inches, and the result will give the number of times the diameter is magnified: squaring the diameter will give the superficies; and if the solid content is wanted, it will be shown by multiplying the superficies by the diameter.

The superficies of one side of an object only can be seen at one view; and to compute how much that is magnified, is most commonly sufficient: but sometimes it is satisfactory to know how many minute objects are contained in a larger; as suppose we desire to know how many animalcules are contained in the bulk of a grain of sand: and to answer this, the cube, as well as the surface, must be taken into the account. For the satisfaction of those who are not much versant in these subjects, we shall here subjoin the following tables taken from the Appendix to Ferguson's Lectures.

247 Tables of the magnifying power of microscopes.

The first column contains the focal length of the convex lens in hundredths of an inch. The second contains the number of times which such a lens will magnify the diameter of objects: The third shews the number of times that the surface is magnified; and the fourth the number of times that the cube of the object is magnified. A table of a similar kind, though upon a much smaller scale, has already been published; but the nearest distance at which the eye can see distinctly, is there supposed to be *eight* inches, which we are confident, from experience, is too large an estimate for the generality of eyes. Table I. is therefore computed upon the supposition that the distance alluded to is *seven* inches.

" When we consider however (says the editor of the work now quoted) that the eye examines very minute objects at a less distance than it does objects of a greater magnitude, we shall find that the magnifying power of lenses ought to be deduced from the *distance at which the eye examines objects really microscopic*. This circumstance has been overlooked by every writer on optics, and merits our attentive consideration. We have now before us two specimens of engraven characters

racters. The one is so large that it can be easily read at the distance of ten inches; and the other is so exceedingly minute that it cannot be read at a greater distance than five inches. Now we maintain that if these two kinds of engraving are seen through the *same microscope*, the one will be *twice* as much magnified as the other. This indeed is obvious; for as the magnifying power of a lens is equal to the distance at which the object is examined by the naked eye divided by the focal length of the lens, we shall have $\frac{5}{x}$ for the number of times which the minute engraving is magnified, and $\frac{10}{x}$ for the number of times that the large engraving is magnified, x being the focal length of the lens. It follows, therefore, that the number of times that any lens magnifies objects really microscopic should be determined, by making the distance at which they are examined by the naked eye about five inches.

Upon this principle we have computed TABLE II. which contains the magnifying power of convex lenses when employed to examine microscopic objects.

TABLE I.

A NEW TABLE of the magnifying power of small convex lenses or single microscopes, the distance at which the eye sees distinctly being seven inches.

Focal distance of the lens or microscope. Inches and parts of an inch.	100dths of an inch.	Number of times that the *diameter* of an object is magnified. Times. Dec. of a time.	Number of times that the *surface* of an object is magnified. Times.	Number of times that the *cube* of an object is magnified. Times.
1 or	100	7.00	49	343
3/4 or	75	9.33	87	810
1/2 or	50	14.00	196	2744
2/5 or	40	17.50	306	5360
3/10 or	30	23.33	544	12698
2/10 or	20	35.00	1225	42875
	19	36.84	1354	49836
	18	38.89	1513	58864
	17	41.18	1697	69935
	16	43.75	1910	83453
	15	46.66	2181	101848
	14	50.00	2500	125000
	13	53.85	2894	155721
	12	58.33	3399	198156
	11	63.67	4045	257259
1/10 or	10	70.00	4900	343000
	9	77.78	6053	470911
	8	87.50	7656	669922
	7	100.00	10000	1000000
	6	116.66	13689	1601613
1/20 or	5	140.00	19600	2744000
1/25 or	4	175.00	30625	5359375
	3	233.33	54289	12649337
1/50 or	2	350.00	122500	42875000
	1	700.00	490000	343000000

TABLE II.

A NEW TABLE of the magnifying power of small convex lenses or single microscopes, the distance at which the eye sees distinctly being five inches.

Focal distance of the lens or microscope. Inches and parts of an inch.	100dths of an inch.	Number of times that the *diameter* of an object is magnified. Times. Dec. of a time.	Number of times that the *surface* of an object is magnified. Times.	Number of times that the *cube* of an object is magnified. Times.
1 or	100	5.00	25	125
	75	6.67	44	297
	50	10.00	100	1000
	40	12.50	156	1953
	30	16.67	278	4632
	20	25.00	625	15625
	19	26.32	693	18233
	18	27.78	772	21439
	17	29.41	865	25438
	16	31.25	977	30518
	15	33.33	1111	37026
	14	35.71	1275	45538
	13	38.48	1481	56978
	12	41.67	1736	72355
	11	45.55	2075	94507
	10	50.00	2500	125000
	9	55.55	3086	171416
	8	62.50	3906	244141
	7	71.43	5102	364453
	6	83.33	6944	578634
	5	100.00	10000	1000000
	4	125.00	15625	1953125
	3	166.67	27779	4629907
	2	250.00	62500	15625000
	1	500.00	250000	125000000

The greatest magnifier in Mr Leeuwenhoek's cabinet of microscopes, presented to the Royal Society, has its focus nearly at one-twentieth of an inch distance from its centre; and consequently magnifies the diameter of an object 160 times, and the superficies 25,600. But the greatest magnifier in Mr Wilson's single microscopes, as they are now made, has usually a focal length only of the 50th part of an inch; whereby it has a power of enlarging the diameter of an object 400, and its superficies 160,000 times.

248 The magnifying power of the solar microscope calculated differently from that of others.

The magnifying power of the solar microscope must be calculated in a different manner; for here the distance of the screen or sheet on which the image of the object is cast, divided by the focal length of the lens, gives its magnifying power. Suppose, for instance, the lens made use of has its focus at half an inch, and the screen is placed at the distance of five feet, the object will then appear magnified 20 times, and the superficies 14,400 times; and, by putting the screen at a greater distance, you may magnify the object almost as much as you please: but the screen should be placed just at that distance where the object is seen most distinct and clear.

Optical Instruments. With regard to the double reflecting microscope, Mr Baker observes, that the power of the object-lens is indeed greatly increased by the addition of two eye-glasses; but as no object-lens can be used with them of so minute a diameter, or which magnifies of itself near so much as those that can be used alone, the glasses of this microscope, upon the whole, magnify little or nothing more than those of Mr Wilson's single one; the chief advantage arising from a combination of lenses being the sight of a larger portion of the object.

Sect. V. *Telescopes.*

I. The Refracting Telescope.

249 Of the astronomical telescope. 1. *The Astronomical Telescope.*—From what has been said concerning the compound microscope, the nature of the common astronomical telescope will easily be understood: for it differs from the microscope only in this, that the object is placed at so great a distance from it, that the rays of the same pencil flowing from the object, may be considered as falling parallel upon the object-glass; and therefore the image made by that lens is considered as coincident with its focus of parallel rays.

Plate ccclxxxvii. fig. 12. 1. This will appear very plain from fig. 4. in which AB is the object emitting the several pencils of rays A *c d*, B *c d*, &c. but supposed to be at so great a distance from the object-glass, *c d*, that the rays of the same pencil may be considered as parallel to each other; they are therefore supposed to be collected into their respective foci at the points *m* and *p*, situated at the focal distance of the object-glass *c d*. Here they form an image E, and crossing each other proceed diverging to the eye-glass *h g*; which being placed at its own focal distance from the points *m* and *p*, the rays of each pencil, after passing through that glass, will become parallel among themselves; but the pencils themselves will converge considerably with respect to one another, even so as to cross at *e*, very little farther from the glass *g h* than its focus; because, when they entered the glass, their axes were almost parallel, as coming through the object-glass at the point *k*, to whose distance the breadth of the eye-glass in a long telescope bears very small proportion. So that the place of the eye will be nearly at the focal distance of the eye-glass, and the rays of each respective pencil being parallel among themselves, and their axes crossing each other in a larger angle than they would do if the object were to be seen by the naked eye, vision will be distinct, and the object will appear magnified.

250 Its magnifying power. The magnifying power in this telescope is as the focal length of the object-glass to the focal length of the eye-glass.

In order to prove this, we may consider the angle A *k* B as that under which the object would be seen by the naked eye; for in considering the distance of the object, the length of the telescope may be omitted, as bearing no proportion to it. Now the angle under which the object is seen by means of the telescope is *g e h*, which is to the other A *k* B, or its equal *g k h*, as the distance from the centre of the object-glass to that of the eye-glass. The angle, therefore, which an object subtends to an eye assisted by a telescope of this kind, is to that under which it subtends to the naked eye, as the focal length of the object-glass to the focal length of the eye-glass.

It is evident from the figure, that the visible area, or space which can be seen at one view, when we look through this telescope, depends on the breadth of the eye-glass, and not of the object-glass; for if the eye-glass be too small to receive the rays *g m*, *p h*, the extremities of the object could not have been seen at all: a larger breadth of the object-lass conduces only to the rendering each point of the image more luminous, by receiving a larger pencil of rays from each point of the object.

251 Objects seen thro' it inverted. It is in this telescope as in the compound microscope, where we see not the object itself, but only its image CED: now that image being inverted with respect to the object, because the axis of the pencils that flow from the object cross each other at *k*, objects seen through a telescope of this kind necessarily appear inverted.

This is a circumstance not at all regarded by astronomers: but for viewing objects upon the earth, it is convenient that the instrument should represent them in their natural posture; to which use the telescope with three eye-glasses, as represented fig. 13. is peculiarly adapted. Plate cccLxxxviii. fig. 13.

AB is the object sending out the several pencils A *c d*, B *c d*, &c. which passing through the object-glass *c d*, are collected into their respective foci in CD, where they form an inverted image. From this they proceed to the first eye-glass *e f*, whose focus being at *l*, the rays of each pencil are rendered parallel among themselves, and their axes, which were nearly parallel before, are made to converge and cross each other: the second eye-glass *g h*, being so placed that its focus shall fall upon *m*, renders the axes of the pencils which diverge from thence parallel, and causes the rays of each, which were parallel among themselves, to meet again at its focus EF on the other side, where they form a second image inverted with respect to the former, but erect with respect to the object. Now this image being seen by the eye at *a b* through the eye-glass *i k*, affords a direct representation of the object, and under the same angle that the first image CD would have appeared, had the eye been placed at *l*, supposing the eye-glasses to be of equal convexity; and therefore the object is seen equally magnified in this as in the former telescope, that is, as the focal distance of the object-glass to that of any one of the-glasses, and appears erect. 252 Common refracting telescope shows objects erect.

253 Galilean telescope. 2. The *Galilean Telescope* with the concave eye-glass is constructed as follows.

Plate cccLxxxviii. fig. 1. AB is an object sending forth the pencils of rays *g h i*, *k l m*, &c. which, after passing through the object-glass *c d*, tend towards *e* E *f* (where we shall suppose the focus of it to be), in order to form an inverted image there as before; but in their way to it are made to pass through the concave glass *n o*, so placed that its focus may fall upon E, and consequently the rays of the several pencils which were converging towards those respective focal points *e*, E, *f*, will be rendered parallel, but the axes of those pencils crossing each other at F, and diverging from thence, will be rendered more diverging, as represented in the figure. Now these rays entering the pupil of an eye, will form a large and distinct image *a b* upon the retina, which will be inverted with

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with respect to the object, because the axis of the pencils cross in F. The object of course will be seen erect, and the angle under which it will appear will be equal to that which the lines a F, b F, produced back through the eye-glass, form at F.

It is evident, that the less the pupil of the eye is, the less is the visible area seen through a telescope of this kind; for a less pupil would exclude such pencils as proceed from the extremities of the object AB, as is evident from the figure. This inconvenience renders this telescope unfit for many uses; and is only to be remedied by the telescope with the convex eye-glasses, where the rays which form the extreme parts of the image are brought together in order to enter the pupil of the eye, as explained above.

It is apparent also, that the nearer the eye is placed to the eye-glass of this telescope, the larger is the area seen through it; for, being placed close to the glass, as in the figure, it admits rays that come from A and B, the extremities of the object, which it could not if it was placed farther off.

254 Magnifying power.

The degree of magnifying in this telescope is in the same proportion with that in the other, viz. as the focal distance of the object glass is to the focal distance of the eye-glass.

Plate cccLXXXVII. Plate cccLXXXVIII.

For there is no other difference but this, viz. that as the extreme pencils in that telescope were made to converge and form the angle $g\ e\ h$ or $i\ n\ k$ (fig. 13.), these are now made to diverge and form the angle a F b (fig. 1.); which angles, if the concave glass in one has an equal refractive power with the convex one in the other, will be equal, and therefore each kind will exhibit the object magnified in the same degree.

There is a defect in all these kinds of telescopes, not to be remedied in a single lens by any means whatever, which was thought only to arise from the spherical aberration of the object-glass. But it was discovered by Sir Isaac Newton, that the imperfection of this sort of telescope, so far as it arises from the spherical form of the glasses, bears little proportion to that which is owing to the different refrangibility of light. This diversity in the refraction of rays is about a 28th part of the whole; so that the object-glass of a telescope cannot collect the rays which flow from any one point in the object into less space than a circle whose diameter is about the 56th part of the breadth of the glass.

Plate cccLXXXVIII.

To show this, let AB represent a convex lens, and let CDF be a pencil of rays flowing from the point D; let H be the point at which the least refrangible rays are collected to a focus; and I, that where the most refrangible concur. Then, if IH be the 28th part of EH, IK will be a proportionable part of EC (the triangles HIK and HEC being similar): consequently LK will be the 28th part of FC. But MN will be the least space into which the rays will be collected, as appears by their progress represented in the figure. Now MN is but about half of KL; and therefore it is about the 56th part of the breadth of that part of the glass through which the rays pass; which was to be shown.

Since therefore each point of the object will be represented in so large a space, and the centres of those spaces will be contiguous, because the points in the object the rays flow from are so; it is evident, that the image of an object made by such a glass must be a most confused representation, though it does not appear so when viewed through an eye-glass that magnifies in a moderate degree; consequently the degree of magnifying in the eye-glass must not be too great with respect to that of the object-glass, lest the confusion become sensible.

Notwithstanding this imperfection, a dioptrical telescope may be made to magnify in any given degree, provided it be of sufficient length; for the greater the focal distance of the object-glass is, the less may be the proportion which the focal distance of the eye-glass may bear to that of the object-glass, without rendering the image obscure. Thus, an object-glass, whose focal distance is about four feet, will admit of an eye-glass whose focal distance shall be little more than an inch, and consequently will magnify almost 48 times; but an object-glass of 40 feet focus will admit of an eye-glass of only four inches focus, and will therefore magnify 120 times; and an object-glass of 100 feet focus will admit of an eye-glass of little more than six inches focus, and will therefore magnify almost 200 times.

255 Refracting telescopes magnify in proportion to their length.

The reason of this disproportion in their several degrees of magnifying may be explained thus: Since the diameter of the spaces, into which rays flowing from the several points of an object are collected, are as the breadth of an object-glass, it is evident that the degree of confusedness in the image is as the breadth of that glass; for the degree of confusedness will only be as the diameters or breadth of those spaces, and not as the spaces themselves. Now the focal length of the eye-glass, that is, its power of magnifying, must be as that degree; for, if it exceeds it, it will render the confusedness sensible; and therefore it must be as the breadth or diameter of the object-glass. The diameter of the object-glass, which is as the square root of its aperture or magnitude, must be as the square root of the power of magnifying in the telescope; for unless the aperture itself be as the power of magnifying, the image will want light: the square root of the power of magnifying will be as the square root of the focal distance of the object-glass; and therefore the focal distance of the eye-glass must be only as the square root of that of the object-glass. So that in making use of an object-glass of a longer focus, suppose, than one that is given, you are not obliged to apply an eye-glass of a proportionably longer focus than what would suit the given object-glass, but such a one only whose focal distance shall be to the focal distance of that which will suit the given object-glass, as the square root of the focal length of the object-glass you make use of, is to the square root of the focal length of the given one. And this is the reason that longer telescopes are capable of magnifying in a greater degree than shorter ones, without rendering the object confused or coloured.

Upon these principles the following new table, taken from the appendix to Ferguson's Lectures, vol. ii. p. 471. second edition, has been computed. It is founded on a telescope of Huygens, mentioned in his *Astroscopia Compendiaria*, which had an object-glass 34 feet in focal length, and which bore an eye-glass of $2\frac{1}{7}$ inches focal distance, and therefore magnified 163 times. The table for refracting telescopes, which has been given by preceding optical writers, was copied from Smith's Optics,

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tics, as the production of the celebrated Huygens, while it was calculated only by the editors of his Dioptrics, from a telescope made by that celebrated optician; which, however, seems to have been inferior to that which is the foundation of the following table. The table is suited to Rhinland measure; but the second and third columns may be converted into English measure by dividing them by .7, the focal distances of the object-glasses being supposed English feet.

A New Table of the apertures, focal lengths, and magnifying power of refracting telescopes.

Focal length of the object-glass.	Sine or aperture of the eye-glass.	Focal distance of the eye-glass.	Magnifying Power.
Feet.	Inch. Dec.	Inch. Dec.	Times.
1	0.65	0.50	28
2	1.03	0.62	39
3	1.30	0.75	48
4	1.45	0.87	55
5	1.61	1.00	60
6	1.79	1.07	67
7	1.96	1.15	73
8	2.14	1.21	77
9	2.20	1.30	83
10	2.32	1.38	87
13	2.63	1.58	99
15	2.81	1.70	106
20	3.31	1.95	123
25	3.73	2.15	139
30	4.01	2.40	150
35	4.34	2.58	163
40	4.64	2.76	174
45	4.92	2.93	184
50	5.20	3.08	195
55	5.48	3.22	205
60	5.71	3.36	214
70	6.16	3.64	231
80	6.58	3.90	246
90	7.02	4.12	262
100	7.39	4.35	276
200	10.41	6.17	389
300	12.89	7.52	479
400	14.72	8.71	551
500	16.52	9.71	618

Sect. VI. *On Achromatic Telescopes.*

256 Their imperfections remedied by Dollond and Blair.

The inconveniency of very long telescopes is so great, that different attempts have been made to remove it. Of these, the most successful have been by Dollond and Blair; and the general principles upon which these eminent opticians proceeded have been mentioned in the historical part of this article, and in the preceding section. A fuller account of Dr Blair's discovery will be seen in the Transactions of the Royal Society of Edinburgh; and of Dollond's, it may be sufficient to observe, in addition to what has been already said, that the object-glasses of his telescopes are composed of three distinct lenses, two convex and one concave; of which the concave one is placed in the middle, as is represented in fig. 3. where *a* and *c* show the two convex lenses, and *b b* the concave one, which is by the British artists placed in the middle. The two convex ones are made of London crown glass, and the middle one of white flint glass; and they are all ground to spheres of different radii, according to the refractive powers of the different kinds of glass and the intended focal distance of the object-glass of the telescope. According to Boscovich, the focal distance of the parallel rays for the concave lens is one-half, and for the convex glass one-third of the combined focus. When put together, they refract the rays in the following manner. Let *a b*, *a b*, be two red rays of the sun's light falling parallel on the first convex lens *c*. Supposing there was no other lens present but that one, they would be converged into the lines *b e*, *b e*, and at last meet in the focus *q*. Let the lines *g h*, *g h*, represent two violet rays falling on the surface of the lens. These are also refracted, and will meet in a focus; but as they have a greater degree of refrangibility than the red rays, they must of consequence converge more by the same power of refraction in the glass, and meet sooner in a focus, suppose at *r*.—Let now the concave lens *d d* be placed in such a manner as to intercept all the rays before they come to their focus. Were this lens made of the same materials, and ground to the same radius with the convex one, it would have the same power to cause the rays diverge that the former had to make them converge. In this case, the red rays would become parallel, and move on in the line *o o*, *o o*: But the convex lens, being made of flint glass, and upon a shorter radius, has a greater refractive power, and therefore they diverge a little after they come out of it; and if no third lens was interposed, they would proceed diverging in the lines *o p t*, *o p t*; but, by the interposition of the third lens *o v o*, they are again made to converge, and meet in a focus somewhat more distant than the former, as at *x*. By the concave lens the violet rays are also refracted, and made to diverge; but having a greater degree of refrangibility, the same power of refraction makes them diverge somewhat more than the red ones; and thus, if no third lens was interposed, they would proceed in such lines as *l m n*, *l m n*. Now as the differently coloured rays fall upon the third lens with different degrees of divergence, it is plain, that the same power of refraction in that lens will operate upon them in such a manner as to bring them all together to a focus very nearly at the same point. The red rays, it is true, require the greatest power of refraction to bring them to a focus; but they fall upon the lens with the least degree of divergence. The violet rays, though they require the least power of refraction, yet have the greatest degree of divergence; and thus all meet together in the point *x*, or nearly so.

Fig. 3. Fig. 4.

But, though we have hitherto supposed the refraction of the concave lens to be greater than that of the convex ones, it is easy to see how the errors occasioned by the first lens may be corrected by it, though it should have even a less power of refraction than the convex one. Thus, let *a b*, *a b*, be two rays of red light falling upon the convex lens *c*, and refracted into the focus *q*; let also *g h*, *g h*, be two violet rays converged into a focus at *r*; it is not necessary, in order to their convergence into a common focus at *x*, that the concave lens should make them *diverge*: it is sufficient if the glass has

Plate cclxxxviii fig. 5.

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has a power of dispersing the violet rays somewhat more than the red ones; and many kinds have this power of dispersing some kinds of rays, without a very great power of refraction. It is better, however, to have the object-glass composed of three lenses; because there is then another correction of the aberration by means of the third lens; and it might be impossible to find two lenses, the errors of which would exactly correct each other. It is also easy to see, that the effect may be the same whether the concave glass is a portion of the same sphere with the others or not; the effect depending upon a combination of certain circumstances, of which there is an infinite variety.

By means of this correction of the errors arising from the different refrangibility of the rays of light, it is possible to shorten refracting telescopes considerably, and yet leave them equal magnifying powers. The reason of this is, that the errors arising from the object-glass being removed, those which are occasioned by the eye-glass are inconsiderable: for the error is always in proportion to the length of the focus in any glass; and in very long telescopes it becomes exceedingly great, being no less than $\frac{1}{18}$th of the whole; but in glasses of a few inches focus it becomes trifling. Refracting telescopes, which go by the name of *Dollond's*, are therefore now constructed in the following manner. Let AB represent an object-glass composed of three lenses as above described, and converging the rays 1, 2, 3, 4, &c. to a very distant focus as at *x*. By means of the interposed lens CD, however, they are converged to one much nearer, as at *y*, where an image of the object is formed. The rays diverging from thence fall upon another lens EF, where the pencils are rendered parallel, and an eye placed near that lens would see the object magnified and very distinct. To increase the magnifying power still more, however, the pencils thus become parallel are made to fall upon another at GH; by which they are again made to converge to a distant focus: but, being intercepted by the lens IK, they are made to meet at the nearer one *z*; whence diverging to LM, they are again rendered parallel, and the eye at N sees the object very distinctly.

Fig. 6.

From an inspection of the figure it is evident, that Dollond's telescope thus constructed is two telescopes combined together; the first ending with the lens EF, and the second with LM. In the first we do not perceive the object itself, but the image of it formed at *y*; and in the second we perceive only the image of that image formed at *z*. Such telescopes are nevertheless exceedingly distinct, and represent objects so clearly as to be preferred, in viewing terrestrial things, even to reflectors. The latter indeed have greatly the advantage in their powers of magnifying, but they are much deficient in point of light. Much more light is lost by reflection than by refraction: and as in these telescopes the light must unavoidably suffer two reflections, a great deal of it is lost; nor is this loss counterbalanced by the greater aperture which these telescopes will bear, which enables them to receive a greater quantity of light than the refracting ones. The metals of reflecting telescopes also are very much subject to tarnish, and require much more dexterity to clean them than the glasses of refractors; which makes them more troublesome and expensive, though for making discoveries in the heavens they are undoubtedly the only proper instruments which have been hitherto constructed.

II. The Reflecting Telescope.

257 Newtonian telescope.

The inconveniences arising from the great length of refracting telescopes, before the discovery of the achromatic telescope, are sufficiently obvious; and these, together with the difficulties occasioned by the different refrangibility of light, induced Sir Isaac Newton to turn his attention to the subject of reflection, and endeavour to realize the ideas of himself and others concerning the possibility of constructing telescopes upon that principle.—The instrument which he contrived is represented, fig. 7. where ABCD is a large tube, open at AD and closed at BC, and of a length at least equal to the distance of the focus from the metallic spherical concave speculum GH placed at the end BC. The rays EG, FH, &c. proceeding from a remote object PR, intersect one another somewhere before they enter the tube, so that EG, *e g*, are those that come from the lower part of the object, and *f h*, FH from its upper part: these rays after falling on the speculum GH, will be reflected so as to converge and meet in *m n*, where they will form a perfect image of the object.—But as this image cannot be seen by the spectator, they are intercepted by a small plane metallic speculum KK, intersecting the axis at an angle of 45°, by which the rays tending to *m n* will be reflected towards a hole LL in the side of the tube, and the image will be less distinct, because some of the rays which would otherwise fall on the concave speculum GH, are intercepted by the plane speculum: nevertheless it will appear in a considerable degree distinct, because the aperture AD of the tube, and the speculum GH, are large. In the lateral hole LL is fixed a convex lens, whose focus is at S*q*; and therefore this lens will refract the rays that proceed from any point of the image, so as at their exit they will be parallel, and those that proceed from the extreme points S *q* will converge after refraction, and form an angle at O, where the eye is placed; which will see the image S *q*, as if it were an object through the lens LL; consequently the object will appear enlarged, inverted, bright, and distinct. In LL lenses of different convexities may be placed, which by being moved nearer to the image or farther from it, would represent the object more or less magnified, provided that the surface of the speculum GH be of a perfectly spherical figure. If, in the room of one lens LL, three lenses be disposed in the same manner with the three eye-glasses of the refracting telescope, the object will appear erect, but less distinct than when it is observed with one lens.

Fig. 7.

258 New finder for Newtonian telescope.

On account of the position of the eye in this telescope, it is extremely difficult to direct the instrument towards any object. Huygens, therefore, first thought of adding to it a small refracting telescope, the axis of which is parallel to that of the reflector. This is called a *finder* or *director*. When the Newtonian telescope is large, and placed upon its lower end to view bodies in great altitudes, the common finder can be of no use, from the difficulty of getting the eye to the eye-piece. On this account Dr Brewster proposes (Appendix to Ferguson's Lectures, vol. ii. p. 478.) to bend the tube of the finder to a right angle, and place a plane mirror at the angular point, so as to throw the image above the upper part of the tube that

that the eye-piece of the finder may be as near as possible to the eye-piece of the telescope. The angular part where the plain mirror is to be fixed, should be placed as near as possible to the focal image, in order that only a small part of the finder may stand above the tube; and in this way the eye can be transferred with the greatest facility from the one eye-piece to the other. The advantages of this construction will be understood from fig. 3. Plate CCCLXXXIX. where TT is part of a Newtonian telescope, D the eye-piece, and ABC the finder. The image formed by the object-glass A is reflected upwards by the plain mirror B, placed at an angle of 45° with the axis of the tube, and the image is viewed with the eye-glass AC. Those who have been in the habit of using the Newtonian telescope with the common finder will be sensible of the convenience resulting from this contrivance.

Plate CCCLXXXIX. fig. 3.

259 Magnifying power of Newtonian telescopes.

In order to determine the magnifying power of this telescope, it is to be considered that the plane speculum KK is of no use in this respect. Let us then suppose, that one ray proceeding from the object coincides with the axis GLIA of the lens and speculum; let *b b* be another ray proceeding from the lower extreme of the object, and passing through the focus I of the speculum KH: this will be reflected in the direction *b i d*, parallel to the axis G L A, and falling on the lens *d* L *d*, will be refracted to G; so that G L will be equal to L *l*, and *d* G = *d* I. To the naked eye the object would appear under the angle I *b i* = *b* I A; but by means of the telescope it appears under the angle *d*GL = *d*IL = I*di*: and the angle I *di* is to the angle I *b i* :: I *b* : I *d*; consequently the apparent magnitude by the telescope is to that by the naked eye as the distance of the focus of the speculum from the speculum, to the distance of the focus of the lens from the lens.

Plate cccLXXXVIII. fig. 8.

The following new table of the apertures and magnifying power of Newtonian telescopes is taken from the Appendix to Ferguson's Lectures, vol. ii. p. 480. It is founded on a Newtonian telescope constructed by Hadley, in which the focal length of the great speculum was three feet three inches, and the magnifying power 226. Its aperture varied from three and a half to four and a half inches according to the want of brightness in the objects to be examined. The first column contains the focal length of the great speculum in feet, and the second its linear aperture in inches, and hundredths of an inch. The third and fourth columns contain Sir Isaac Newton's numbers, by means of which the apertures of any kind of reflecting telescopes may be easily computed. The fifth column contains the focal length of the eye-glasses in thousandths of an inch, and the sixth contains the magnifying power of the instrument.

A NEW TABLE of the apertures and magnifying power of Newtonian Telescopes.

Focal length of the concave speculum.	Aperture of the concave speculum.	Sir Isaac Newton's numbers.		Focal length of the eye-glass.	Magnifying power.
Feet.	Inch. Dec.	Aperture of the speculum	Focal length of the eye-glass	Inch. Dec.	Times.
$\frac{1}{2}$	1.34	100	100	0.107	56
1	2.23	168	119	0.129	93
2	3.79	283	141	0.152	158
3	5.14	383	157	0.168	214
4	6.36	476	168	0.181	265
5	7.51	562	178	0.192	313
6	8.64	645	186	0.200	360
7	9.67			0.209	403
8	10.44	800	200	0.218	445
9	11.69			0.222	487
10	12.65	946	212	0.228	527
11	13.58			0.233	566
12	14.50	1084	221	0.238	604
3	15.41			0.243	642
14	16.25			0.248	677
15	17.11			0.252	713
16	17.98	1345	238	0.256	749
17	18.82			0.260	784
18	19.63			0.264	818
19	20.45			0.268	852
20	21.24	1591	251	0.271	885
21	22.06			0.274	919
22	22.85			0.277	952
23	23.62			0.280	984
24	24.41	1824	263	0.283	1017

Let TYYT be a brass tube, in which L *l d* D is a metallic concave speculum, perforated in the middle at X; and EF a less concave mirror, so fixed by the arm or strong wire RT, which is moveable by means of a long screw on the outside of the tube, as to be moved nearer to or farther from the larger speculum L *l d* D, its axis being kept in the same line with that of the great one. Let AB represent a very remote object, from each part of which issue pencils of rays, e. g. *c d*, CD, from A the upper extreme of the object, and IL, *i l*, from the lower part B; the rays IL, CD, from the extremes crossing one another before they enter the tube. These rays falling upon the larger mirror L D, are reflected from it into the focus K H, where they form an inverted image of the object A B, as in the Newtonian telescope. From this image the rays, issuing as from an object, fall upon the small mirror EF, the centre of which is at *e*; so that after reflection they would meet in their foci at QQ, and there form an erect image. But since an eye at that place could see but a small part of an object, in order to bring rays from more distant parts of it into the pupil, they are intercepted by the plano-convex lens MN, by which means a smaller erect image is formed at P V, which is viewed from

260 Gregorian telescope.

Plate cccLXXXVIII. fig. 9.

from the meniscus SS by an eye at O. This meniscus both makes the rays of each pencil parallel and magnifies the image PV. At the place of this image all the foreign rays are intercepted by the perforated partition ZZ. For the same reason the hole near the eye O is very narrow. When nearer objects are viewed by this telescope, the small speculum EF is removed to a greater distance from the larger LD, so that the second image may be always formed in PV; and this distance is to be adjusted (by means of the screw on the outside of the great tube) according to the form of the eye of the spectator. It is also necessary, that the axis of the telescope should pass through the middle of the speculum EF, and its centre, the centre of the speculum LL, and the middle of the hole X, the centres of the lenses MN, SS, and the hole near O. As the hole X in the speculum LL can reflect none of the rays issuing from the object, that part of the image which corresponds to the middle of the object must appear to the observer more dark and confused than the extreme parts of it. Besides, the speculum EF will also intercept many rays proceeding from the object; and therefore unless the aperture TT be large, the object must appear in some degree obscure.

In the best reflecting telescopes, the focus of the small mirror is never coincident with the focus of the great one, where the first image KH is formed, but a little beyond it (with respect to the eye), as at *n*; the consequence of which is, that the rays of the pencils will not be parallel after reflection from the small mirror, but converge so as to meet in points about Q *q* Q, where they would form a larger upright image than PV, if the glass R was not in their way; and this image might be viewed by means of a single eye-glass properly placed between the image and the eye; but then the field of view would be less, and consequently not so pleasant; for which reason, the glass R is still retained, to enlarge the scope or area of the field.

261 Its magnifying power.

To find the magnifying power of this telescope, mutiply the focal distance of the great mirror by the distance of the small mirror from the image next the eye, and multiply the focal distance of the small mirror by the focal distance of the eye-glass; then divide the former product by the latter, and the quotient will express the magnifying power. For a table of the apertures and powers of Gregorian telescopes, see Appendix to Ferguson's Lectures, vol. ii. p. 472, 473.

One great advantage of the reflecting telescope is, that it will admit of an eye-glass of a much shorter focal distance than a refracting telescope; and consequently it will magnify so much the more: for the rays are not coloured by reflection from a concave mirror, if it be ground to a true figure, as they are by passing through a convex glass, let it be ground ever so true.

The nearer an object is to the telescope, the more its pencils of rays will diverge before they fall upon the great mirror, and therefore they will be the longer of meeting in points after reflection; so that the first image KH will be formed at a greater distance from the large mirror, when the object is near the telescope, than when it is very remote. But as this image must be formed farther from the small mirror than its principal focus *n*, this mirror must be always set at a greater distance from the larger one, in viewing near objects, than in viewing remote ones. And this is done by turning the screw on the outside of the tube, until the small mirror be so adjusted, that the object (or rather its image) appears perfect.

In looking through any telescope towards an object, we never see the object itself, but only that image of it which is formed next the eye in the telescope. For if a man holds his finger or a stick between his bare eye and an object, it will hide part (if not the whole) of the object from his view: But if he ties a stick across the mouth of a telescope before the object-glass, it will hide no part of the imaginary object he saw through the telescope before, unless it covers the whole mouth of the tube: for all the effect will be, to make the object appear dimmer, because it intercepts part of the rays. Whereas, if he puts only a piece of wire across the inside of the tube, between the eye-glass and his eye, it will hide part of the object which he thinks he sees; which proves, that he sees not the real object, but its image. This is also confirmed by means of the small mirror EF, in the reflecting telescope, which is made of opaque metal, and stands directly between the eye and the object towards which the telescope is turned; and will hide the whole object from the eye at O, if the two glasses ZZ and SS are taken out of the tube.

262 Cassegrainian telescope.

If the small mirror of the preceding instrument be convex instead of concave, it is then called the *Cassegrainian telescope*. As the small mirror is in this case placed between the great speculum and its focus, a Cassegrainian telescope will be shorter than a Gregorian one of the same magnifying power by twice the real length of the small mirror. For a table of the apertures, &c. of this instrument, see Appendix to Ferguson's Lectures, vol. ii. p. 474, 475.

Sect. VII. *On the Merits of different Microscopes and Telescopes.*

263 Merits of microscopes and telescopes compared.

The advantages arising from the use of microscopes and telescopes depend, in the first place, upon their property of magnifying the minute parts of objects, so that they can by that means be more distinctly viewed by the eye; and, secondly, upon their throwing more light into the pupil of the eye than what is done without them. The advantages arising from the magnifying power would be extremely limited, if they were not also accompanied by the latter: for if the same quantity of light is spread over a large portion of surface, it becomes proportionably diminished in force; and therefore the objects, though magnified, appear proportionably dim. Thus, though any magnifying glass should enlarge the diameter of the object 10 times, and consequently magnify the surface 100 times, yet if the focal distance of the glass was about eight inches (provided this was possible), and its diameter only about the size of the pupil of the eye, the object would appear 100 times more dim when we looked through the glass, than when we beheld it with our naked eyes; and this, even on a supposition that the glass transmitted all the light which fell upon it, which no glass can do. But if the focal distance of the glass was only four inches, though its diameter remained as before, the inconvenience would be vastly diminished, because the glass could then

Merits of Micro-scopes and Telescopes compared.

then be placed twice as near the object as before, and consequently would receive four times as many rays as in the former case, and therefore we would see it much brighter than before. Going on thus, still diminishing the focal distance of the glass, and keeping its diameter as large as possible, we will perceive the object more and more magnified, and at the same time very distinct and bright. It is evident, however, that with regard to optical instruments of the microscopic kind, we must sooner or later arrive at a limit which cannot be passed. This limit is formed by the following particulars. 1. The quantity of light lost in passing through the glass. 2. The diminution of the glass itself, by which it receives only a small quantity of rays. 3. The extreme shortness of the focal distance of great magnifiers, whereby the free access of the light to the object which we wish to view is impeded, and consequently the reflection of the light from it is weakened. 4. The aberrations of the rays, occasioned by their different refrangibility.

To understand this more fully, as well as to see how far these obstacles can be removed, let us suppose the lens made of such a dull kind of glass, that it transmits only one half of the light which falls upon it. It is evident that such a glass, of four inches focal distance, and which magnifies the diameter of an object twice, still supposing its own breadth equal to that of the pupil of the eye, will show it four times magnified in surface, but only half as bright as if it was seen by the naked eye at the usual distance; for the light which falls upon the eye from the object at eight inches distance, and likewise the surface of the object in its natural size, being both represented by 1, the surface of the magnified object will be 4, and the light which makes that magnified object visible only 2: because though the glass receives four times as much light as the naked eye does at the usual distance of distinct vision, yet one half is lost in passing through the glass. The inconvenience in this respect can therefore be removed only as far as it is possible to increase the clearness of the glass, so that it shall transmit nearly all the rays which fall upon it; and how far this can be done, hath not yet been ascertained.

The second obstacle to the perfection of microscopic glasses is the small size of great magnifiers, by which, notwithstanding their near approach to the object, they receive a smaller quantity of rays than might be expected. Thus suppose, a glass of only $\frac{1}{10}$th of an inch focal distance; such a glass would increase the visible diameter 80 times, and the surface 6400 times. If the breadth of the glass could at the same time be preserved as great as that of the pupil of the eye, which we shall suppose $\frac{2}{10}$ths of an inch, the object would appear magnified 6400 times, at the same time that every part of it would be as bright as it appears to the naked eye. But if we suppose that this magnifying glass is only $\frac{1}{10}$th of an inch in diameter, it will then only receive $\frac{1}{4}$th of the light which otherwise would have fallen upon it; and therefore, instead of communicating to the magnified object a quantity of illumination equal to 6400, it would communicate only one equal to 1600, and the magnified object would appear four times as dim as it does to the naked eye. This inconvenience, however, is still capable of being removed, not indeed by increasing the diameter of the lens, because this must be in proportion to its focal distance, but by throwing a greater quantity of light on the object. Thus, in the above-mentioned example, if four times the quantity of light which naturally falls upon it could be thrown upon the object, it is plain that the reflection from it would be four times as great as in the natural way; and consequently the magnified image, at the same time that it was as many times magnified as before, would be as bright as when seen by the naked eye. In transparent objects this can be done very effectually by a concave speculum, as in the reflecting microscope already described: but in opaque objects the case is somewhat more doubtful; neither do the contrivances for viewing these objects seem entirely to make up for the deficiencies of the light from the smallness of the lens and shortness of the focus.—When a microscopic lens magnifies the diameter of an object forty times, it hath then the utmost possible magnifying power, without diminishing the natural brightness of the object.

The third obstacle arises from the shortness of the focal distance in large magnifiers: but in transparent objects, where a sufficient quantity of light is thrown on the object from below, the inconvenience arises at last from straining the eye, which must be placed nearer the glass than it can well bear; and this entirely supersedes the use of magnifiers beyond a certain degree.

The fourth obstacle arises from the different refrangibility of the rays of light, and which frequently causes such a deviation from truth in the appearances of things that many people have imagined themselves to have made surprising discoveries, and have even published them to the world: when in fact they have been only as many optical deceptions, owing to the unequal refractions of the rays. For this there seems to be no remedy, except the introduction of achromatic glasses into microscopes as well as telescopes. How far this is practicable, hath not yet been tried; but when these glasses shall be introduced (if such introduction is practicable,) microscopes will then undoubtedly have received their ultimate degree of perfection.

364 Dollond's and Blair's refracting telescopes superior to others.

With regard to telescopes, those of the refracting kind have evidently the advantage of all others, where the aperture is equal, and the aberrations of the rays are corrected according to Mr Dollond's method; because the image is not only more perfect, but a much greater quantity of light is transmitted than what can be reflected from the best materials hitherto known. Unluckily, however, the imperfections of the glass set a limit to these telescopes, as has been already observed, so that they cannot be made above three feet and a half long. On the whole, therefore, the reflecting telescopes are preferable in this respect, that they may be made of dimensions greatly superior; by which means they can both magnify to a greater degree, and at the same time throw much more light into the eye.

With regard to the powers of telescopes, however, they are all of them exceedingly less than what we would be apt to imagine from the number of times which they magnify the object. Thus, when we hear of a telescope which magnifies 200 times, we are apt to imagine, that, on looking at any distant object through it, we should perceive it as distinctly as we would with our naked eye at the 200th part of the

Merits of Microscopes and Telescopes compared. the distance. But this is by no means the case; neither is there any theory capable of directing us in this matter: we must therefore depend entirely on experience.

The best method of trying the goodness of any telescope is to observe how much farther off you are able to read with it than with the naked eye. But that all deception may be avoided, it is proper to choose something to be read where the imagination cannot give any assistance, such as a table of logarithms, or something which consists entirely of figures; and hence the truly useful power of the telescope is easily known. In this way Mr Short's large telescope, which magnifies the diameter of objects 1200 times, is yet unable to afford sufficient light for reading at more than 200 times the distance at which we can read with our naked eye.

265 The Gregorian telescope superior for common use to the Newtonian. With regard to the form of reflecting telescopes, it is now pretty generally agreed, that when the Gregorian ones are well constructed, they have the advantage of those of the Newtonian form. One advantage evident at first sight is, that with the Gregorian telescope an object is perceived by looking directly through it, and consequently is found with much greater ease than in the Newtonian telescope, where we must look into the side. The unavoidable imperfection of the specula common to both, also gives the Gregorian an advantage over the Newtonian form. Notwithstanding the utmost care and labour of the workmen, it is found impossible to give the metals either a perfectly spherical or a perfectly parabolical form. Hence arises some indistinctness of the image formed by the great speculum; which is frequently corrected by the little one, provided they are properly matched. But if this is not done, the error will be made much worse; and hence many of the Gregorian telescopes are far inferior to the Newtonian ones; namely, when the specula have not been properly adapted to each other. There is no method by which the workman can know the specula which will fit one another without a trial; and therefore it is necessary to have many specula ready made of each sort, that in fitting up a telescope those may be chosen which best suit each other.

The brightness of any object seen through a telescope, in comparison with its brightness when seen by the naked eye, may in all cases be easily found by the following formula. Let n represent the natural distance at which an object can be distinctly seen; and let d represent its distance from the object-glass of the instrument. Let m be the magnifying power of the instrument; that is, let the visual angle subtended at the eye by the object when at the distance n, and viewed without the instrument, be to the visual angle produced by the instrument as 1 to m. Let a be the diameter of the object-glass, and p that of the pupil. Let the instrument be so constructed, that no parts of the pencils are intercepted for want of sufficient apertures of the intermediate glasses. Lastly, Let the light lost in reflection or refraction be neglected.

The brightness of vision through the instrument will be expressed by the fraction $\frac{a^2 n^2}{m^2 p^2 d^2}$, the brightness of natural vision being 1. But although this fraction may exceed unity, the vision through the instrument will not be brighter than natural vision. For, when this is the case, the pupil does not receive all the light transmitted through the instrument.

In microscopes, n is the nearest limits of distinct vision, nearly *seven* inches. But a difference in this circumstance, arising from a difference in the eye, makes no change in the formula, because m changes in the same proportion with n.

In telescopes n and d may be reckoned equal, and the formula becomes $\frac{a^2}{m^2 p^2}$.

A view of the history and construction of the telescope is given in the article ACHROMATIC GLASSES, in the SUPPLEMENT.

SECT. VIII. *Apparatus for Measuring the Intensity of Light.*

That some luminous bodies give a stronger, and others a weaker light, and that some reflect more light than others, was always known; but no person, before M. Bouguer hit upon a tolerable method of ascertaining the proportion that two or more lights bear to one another. The methods he most commonly used were the following. 266 M. Bouguer's contrivances for measuring light.

He took two pieces of wood or pasteboard EC and CD, in which he made two equal holes P and Q, over which he drew pieces of oiled or white paper. Upon these holes he contrived that the light of the different bodies he was comparing should fall; while he placed a third piece of pasteboard FC, so as to prevent the two lights from mixing with one another. Then placing himself sometimes on one side, and sometimes on the other, but generally on the opposite side of this instrument, with respect to the light, he altered their position till the papers in the two holes appeared to be equally enlightened. This being done, he computed the proportion of their light by the squares of the distances at which the luminous bodies were placed from the objects. If, for instance, the distances were as three and nine, he concluded that the lights they gave were as nine and eighty-one. Where any light was very faint, he sometimes made use of lenses, in order to condense it; and he enclosed them in tubes or not as his particular application of them required. Plate CCCLXXXV. fig. 4.

To measure the intensity of light proceeding from the heavenly bodies, or reflected from any part of the sky, he contrived an instrument which resembles a kind of portable camera obscura. He had two tubes, of which the inner was black, fastened at their lower extremities by a hinge C. At the bottom of these tubes were two holes, R and S, three or four lines in diameter, covered with two pieces of fine white paper. The two other extremities had each of them a circular aperture, an inch in diameter; and one of the tubes consisted of two, one of them sliding into the other, which produced the same effect as varying the aperture at the end. When this instrument is used, the observer has his head, and the end of the instrument C, so covered, that no light can fall upon his eye, besides that which comes through the two holes S and R, while an assistant manages the instrument, and draws out or shortens the tube DE, as the observer directs. When the two holes appear equally illuminated, the intensity of the lights is judged to be inversely as the squares of the tubes. Fig. 5.

[illegible] of the ob- [illegible] aperture & [illegible], for, other- [illegible] no effect. To [illegible] of an incon- [illegible] is too narrow, [illegible]. He constructs an [illegible], consisting of two ob- [illegible], exactly equal, fixed in the [illegible] feet, or, in some cases, [illegible] their foci at the other [illegible]. At the bottoms of these tubes B, are two holes, [illegible] in diameter, covered with a piece of [illegible] paper, and this instrument is used exactly like the former.

If the two objects to be observed by this instrument be not equally luminous, the light that issues from them must be reduced to an equality, by diminishing the aperture of one of the object glasses; and then the remaining surface of the two glasses will give the proportion of their lights. But for this purpose, the central parts of the glass must be covered in the same proportion with the parts near the circumference, leaving the aperture such as is represented (fig. 7.), because the middle part of the glass is thicker and less transparent than the rest.

Fig. 7.

If all the objects to be observed lie nearly in the same direction, Bouguer remarks, that these two long tubes may be reduced into one, the two object-glasses being placed close together, and one eye-glass sufficing for them both. The instrument will then be the same with that of which he published an account in 1748, and which he called a *heliometer*, or *astrometer*.

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These instruments measure only the intensity of light.

It is not, however, the absolute quantity, but only the intensity of the light, that is measured by these two instruments, or the number of rays, in proportion to the surface of the luminous body; and it is of great importance that these two things be distinguished. The intensity of light may be very great, when the quantity, and its power of illuminating other bodies, may be very small, on account of the smallness of its surface; or the contrary may be the case, when the surface is large.

Having explained these methods which M. Bouguer took to measure the different proportions of light, we shall subjoin a few examples of his application of them.

It is observable, that when a person stands in a place where there is a strong light, he cannot distinguish objects that are placed in the shade; nor can he see any thing upon going immediately into a place where there is very little light. It is plain, therefore, that the action of a strong light upon the eye, and also the impression which it leaves upon it, makes it insensible to the effect of a weaker light. M. Bouguer had the curiosity to endeavour to ascertain the proportion between the intensities of the two lights in this case; and by throwing the light of two equal candles upon a board, he found [illegible] shadow made by intercepting the light of one [illegible] could not be perceived by his eye, upon the [illegible]ightened by the other, at little more than eight [illegible] distance; from whence he concluded, that [illegible] light is eight times eight, or 64 times less [illegible] other, its presence or absence will not be per[illegible]. He allows, however, that the effect may be different on different eyes; and supposes that the boundaries in this case, with respect to different persons, may lie between 60 and 80.

Apparatus for Measuring Light.

Applying the two tubes of his instrument, mentioned above, to measure the intensity of the light reflected from different parts of the sky; he found that when the sun was 25 degrees high, the light was four times stronger at the distance of eight or nine degrees from his body, than it was at 31 or 32 degrees. But what struck him the most was to find, that when the sun is 15 or 20 degrees high, the light decreases on the same parallel to the horizon to 110 or 120 degrees, and then increases again to the place exactly opposite to the sun.

The light of the sun, our author observes, is too strong, and that of the stars too weak, to determine the variation of their light at different altitudes; but as, in both cases, it must be in the same proportion with the diminution of the light of the moon in the same circumstances, he made his observations on that luminary, and found, that its light at 19° 16′, is to its light at 66° 11′, as 1681 to 2500; that is, the one is nearly two thirds of the other. He chose those particular altitudes, because they are those of the sun at the two solstices at Croisic, where he then resided. When one limb of the moon touched the horizon of the sea, its light was 2000 times less than at the altitude of 66° 11′. But this proportion he acknowledges must be subject to many variations, the atmosphere near the earth varying so much in its density. From this observation he concludes, that [illegible] light is diminished in the proportion of [illegible] to 1681, in traversing 7469 toises of [illegible] air.

268
Great variation of the light of the moon at different altitudes.

M. Bouguer [illegible] applied his instrument to the different [illegible], and found that the centre [illegible] than the extremities of [illegible] the observation, it [illegible] part of the disk [illegible] of [illegible] proportion of 35 to [illegible] than in the proportion of [illegible] of the angles of obliquity. On the other hand, he observes, that both the primary and secondary planets are more luminous at their edges than near their centres.

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Variation in different parts of the disks of the sun and planets.

The comparison of the light of the sun and moon is a subject that has frequently exercised the thoughts of philosophers; but we find nothing but random conjectures, before Bouguer applied his accurate measures in this case. In general, the light of the moon is imagined to bear a much greater proportion to that of the sun than it really does: and not only are the imaginations of the vulgar, but those of philosophers also, imposed upon with respect to it. It was a great surprise to M. de la Hire to find that he could not, by the help of any burning mirror, collect the beams of the moon in a sufficient quantity to produce the least sensible heat. Other philosophers have since made the like attempts with mirrors of greater power, though without any greater success; but this will not surprise us, when we see the result of M. Bouguer's observations on this subject.

In order to solve this curious problem concerning the comparison of the light of the sun and moon, he compared each of them to that of a candle in a dark room, one in the day-time, and the other in the night following,

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M. Bouguer's calculation concerning the light of the moon.

Apparatus for Measuring Light.

ing, when the moon was at her mean distance from the earth; and, after many trials, he concluded that the light of the sun is about 300,000 times greater than that of the moon; which is such a disproportion, that, as he observes, it can be no wonder that philosophers have had so little success in their attempts to collect the light of the moon with burning glasses. For the largest of them will not increase the light 1000 times; which will still leave the light of the moon, in the focus of the mirror, 300 times less than the intensity of the common light of the sun.

To this account of the proportion of light which we actually receive from the moon, it cannot be displeasing to the reader, if we compare it with the quantity which would have been transmitted to us from that opaque body, if it reflected all the light it receives. Dr Smith thought that he had proved, from two different considerations, that the light of the full moon would be to our day-light as 1 to about 90,900, if no rays were lost at the moon.

271 Dr Smith's calculation.

In the first place, he supposes that the moon enlightened by the sun, is as luminous as the clouds are at a medium. He therefore supposed the light of the sun to be equal to that of a whole hemisphere of clouds, or as many moons as would cover the surface of the heavens. But on this Dr Priestley observes, that it is true, the light of the sun shining perpendicularly upon any surface would be equal to the light reflected from the whole hemisphere, if every part reflected all the light that fell upon it; but the light that would in fact be received from the whole hemisphere (part of it being received obliquely) would be only one-half as much as would be received from the whole hemisphere, if every part of it shone directly upon the surface to be illuminated.

In his Remarks, par. 97. Dr Smith demonstrates his method of calculation in the following manner.

Plate cccLxxiv. fig. 8.

"Let the little circle *cfdg* represent the moon's body half enlightened by the sun, and the great circle *a e b*, a spherical shell concentric to the moon, and touching the earth; *a b*, any diameter of that shell perpendicular to a great circle of the moon's body, represented by its diameter *c d*; *e* the place of the shell receiving full moon light from the bright hemisphere *f d g*. Now, because the surface of the moon is rough like that of the earth, we may allow that the sun's rays, incident upon any small part of it, with any obliquity, are reflected from it every way alike, as if they were emitted. And, therefore, if the segment *d f* shone alone, the points *a*, *e*, would be equally illuminated by it; and likewise if the remaining bright segment *d g* shone alone, the points *b e* would be equally illuminated by it. Consequently, if the light at the point *a* was increased by the light at *b*, it would become equal to the full moon light at *e*. And conceiving the same transfer to be made from every point of the hemispherical surface *h b i k* to their opposite points in the hemisphere *k a c h*, the former hemisphere would be left quite dark, and the latter would be uniformly illuminated with full moon light; arising from a quantity of the sun's light, which immediately before its incidence on the moon, would uniformly illuminate a circular plane equal to a great circle of her body, called her *disk*. Therefore the quantities of light being the same upon both surfaces, the density of the sun's incident light is to the density of full moon light, as that hemispherical surface *h e k* is to the said disk; that is, as any other hemispherical surface whose centre is at the eye, to that part of it which the moon's disk appears to possess very nearly, because it subtends but a small angle at the eye: that is, as radius of the hemisphere to the versed sine of the moon's apparent semidiameter, or as 10,000,000 to $1106\frac{2}{7}$ or as 90,400 to 1; taking the moon's mean horizontal diameter to be 16′ 7″.

"Strictly speaking, this rule compares moon light at the earth with day light at the moon; the medium of which, at her quadratures, is the same as our day-light; but is less at her full in the duplicate ratio of 365 to 366, or thereabout, that is, of the sun's distances from the earth and full moon; and therefore full moon light would be to our day light as about 1 to 90,900, if no rays were lost at the moon.

"Secondly, I say that full moon light is to any other moon light as the whole disk of the moon to the part that appears enlightened, considered upon a plane surface. For now let the earth be at *b*, and let *d l* be perpendicular to *f g*, and *g m* to *c d*: then it is plain, that *g l* is equal to *d m*; and that *g l* is equal to a perpendicular section of the sun's rays incident upon the arch *d g* which at *b* appears equal to *d m*; the eye being unable to distinguish the unequal distances of its parts. In like manner, conceiving the moon's surface to consist of innumerable physical circles parallel to *c f d g*, as represented at A, the same reason holds for every one of these circles as for *c f d g*. It follows then, that the bright part of the surface visible at *b*, when reduced to a flat as represented at B, by the crescent *p d q m p*, will be equal and similar to a perpendicular section of all the rays incident on that part, represented at C by the crescent *p g q l p*. Now the whole disk being in proportion to this crescent as the quantities of light incident upon them; and the light falling upon every rough particle, being equally rarefied in diverging to the eye at *b*, considered as equidistant from them all; it follows, that full moon light is to this moon light as the whole disk *p d q c* to the crescent *p d q m p*. Fig. 9.

"Therefore by compounding this ratio with that in the former remark, day-light is to moon-light as the surface of an hemisphere whose centre is at the eye, to the part of that surface which appears to be possessed by the enlightened part of the moon."

272 Mr Michell's calculation.

Mr Michell made his computation in a much more simple and easy manner, and in which there is much less danger of falling into any mistake. Considering the distance of the moon from the sun, and that the density of the light must decrease in the proportion of the square of that distance, he calculated the density of the sun's light, at that distance, in proportion to its density at the surface of the sun; and in this manner he found, that if the moon reflected all the light it receives from the sun, it would only be the 45,000th part of the light we receive from the greater luminary. Admitting, therefore, that moon-light is only a 300,000th part of the light of the sun, Mr Michell concludes, that it reflects no more than between the 6th and 7th part of what falls upon it.

273 Rumford's photometer.

Could Rumford, has constructed a *photometer*, in which the shadows, instead of being thrown upon a paper spread out upon the wainscot, or side of the room, are projected upon the inside of the back part

Apparatus for Measuring Light.

In using this instrument, it is necessary that the object should subtend an angle larger than the aperture A or D, seen from the other end of the tube; for, otherwise, the lengthening of the tube has no effect. To avoid, in this case, making the instrument of an inconvenient length, or making the aperture D too narrow, he has recourse to another expedient. He constructs an instrument, represented (fig. 6.), consisting of two object-glasses, AE and DF, exactly equal, fixed in the ends of two tubes six or seven feet, or, in some cases, 10 or 12 feet long, and having their foci at the other ends. At the bottoms of these tubes B, are two holes, three or four lines in diameter, covered with a piece of white paper; and this instrument is used exactly like the former.

Fig. 6.

If the two objects to be observed by this instrument be not equally luminous, the light that issues from them must be reduced to an equality, by diminishing the aperture of one of the object-glasses; and then the remaining surface of the two glasses will give the proportion of their lights. But for this purpose, the central parts of the glass must be covered in the same proportion with the parts near the circumference, leaving the aperture such as is represented (fig. 7.), because the middle part of the glass is thicker and less transparent than the rest.

Fig. 7.

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267 These instruments measure only the intensity of light.

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Having explained these methods which M. Bouguer took to measure the different proportions of light, we shall subjoin a few examples of his application of them.

It is observable, that when a person stands in a place where there is a strong light, he cannot distinguish objects that are placed in the shade; nor can he see any thing upon going immediately into a place where there is very little light. It is plain, therefore, that the action of a strong light upon the eye, and also the impression which it leaves upon it, makes it insensible to the effect of a weaker light. M. Bouguer had the curiosity to endeavour to ascertain the proportion between the intensities of the two lights in this case; and by throwing the light of two equal candles upon a board, he found that the shadow made by intercepting the light of one of them, could not be perceived by his eye, upon the place enlightened by the other, at little more than eight times the distance; from whence he concluded, that when one light is eight times eight, or 64 times less than another, its presence or absence will not be perceived. He allows, however, that the effect may be different on different eyes; and supposes that the boundaries in this case, with respect to different persons, may lie between 60 and 80.

Applying the two tubes of his instrument, mentioned above, to measure the intensity of the light reflected from different parts of the sky; he found that when the sun was 25 degrees high, the light was four times stronger at the distance of eight or nine degrees from his body, than it was at 31 or 32 degrees. But what struck him the most was to find, that when the sun is 15 or 20 degrees high, the light decreases on the same parallel to the horizon to 110 or 120 degrees, and then increases again to the place exactly opposite to the sun.

268 Great variation of the light of the moon at different altitudes.

The light of the sun, our author observes, is too strong, and that of the stars too weak, to determine the variation of their light at different altitudes; but as, in both cases, it must be in the same proportion with the diminution of the light of the moon in the same circumstances, he made his observations on that luminary, and found, that its light at 19° 16′, is to its light at 66° 11′, as 1681 to 2500; that is, the one is nearly two thirds of the other. He chose those particular altitudes, because they are those of the sun at the two solstices at Croisic, where he then resided. When one limb of the moon touched the horizon of the sea, its light was 2000 times less than at the altitude of 66° 11′. But this proportion he acknowledges must be subject to many variations, the atmosphere near the earth varying so much in its density. From this observation he concludes, that at a medium light is diminished in the proportion of about 2500 to 1681, in traversing 7469 toises of dense air.

269 Variation in different parts of the disks of the sun and planets.

M. Bouguer also applied his instrument to the different parts of the sun's disk, and found that the centre is considerably more luminous than the extremities of it. As near as he could make the observation, it was more luminous than a part of the disk ¾ths of the semidiameter from it, in the proportion of 35 to 28; which, as he observes, is more than in the proportion of the sines of the angles of obliquity. On the other hand, he observes, that both the primary and secondary planets are more luminous at their edges than near their centres.

The comparison of the light of the sun and moon is a subject that has frequently exercised the thoughts of philosophers; but we find nothing but random conjectures, before Bouguer applied his accurate measures in this case. In general, the light of the moon is imagined to bear a much greater proportion to that of the sun than it really does: and not only are the imaginations of the vulgar, but those of philosophers also, imposed upon with respect to it. It was a great surprise to M. de la Hire to find that he could not, by the help of any burning mirror, collect the beams of the moon in a sufficient quantity to produce the least sensible heat. Other philosophers have since made the like attempts with mirrors of greater power, though without any greater success; but this will not surprise us, when we see the result of M. Bouguer's observations on this subject.

270 M. Bouguer's calculation concerning the light of the moon.

In order to solve this curious problem concerning the comparison of the light of the sun and moon, he compared each of them to that of a candle in a dark room, one in the day-time, and the other in the night following,

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ing, when the moon was at her mean distance from the earth; and, after many trials, he concluded that the light of the sun is about 300,000 times greater than that of the moon; which is such a disproportion, that, as he observes, it can be no wonder that philosophers have had so little success in their attempts to collect the light of the moon with burning glasses. For the largest of them will not increase the light 1000 times; which will still leave the light of the moon, in the focus of the mirror, 300 times less than the intensity of the common light of the sun.

To this account of the proportion of light which we actually receive from the moon, it cannot be displeasing to the reader, if we compare it with the quantity which would have been transmitted to us from that opaque body, if it reflected all the light it receives. Dr Smith thought that he had proved, from two different considerations, that the light of the full moon would be to our day-light as 1 to about 90,900, if no rays were lost at the moon.

271 Dr Smith's calculation.

In the first place, he supposes that the moon enlightened by the sun, is as luminous as the clouds are at a medium. He therefore supposed the light of the sun to be equal to that of a whole hemisphere of clouds, or as many moons as would cover the surface of the heavens. But on this Dr Priestley observes, that it is true, the light of the sun shining perpendicularly upon any surface would be equal to the light reflected from the whole hemisphere, if every part reflected all the light that fell upon it; but the light that would in fact be received from the whole hemisphere (part of it being received obliquely) would be only one-half as much as would be received from the whole hemisphere, if every part of it shone directly upon the surface to be illuminated.

In his Remarks, par. 97. Dr Smith demonstrates his method of calculation in the following manner.

Plate cclxxxiv. fig. 8.

"Let the little circle $cfdg$ represent the moon's body half enlightened by the sun, and the great circle aeb, a spherical shell concentric to the moon, and touching the earth; ab, any diameter of that shell perpendicular to a great circle of the moon's body, represented by its diameter cd; e the place of the shell receiving full moon light from the bright hemisphere fdg. Now, because the surface of the moon is rough like that of the earth, we may allow that the sun's rays, incident upon any small part of it, with any obliquity, are reflected from it every way alike, as if they were emitted. And, therefore, if the segment df shone alone, the points a, e, would be equally illuminated by it; and likewise if the remaining bright segment dg shone alone, the points be would be equally illuminated by it. Consequently, if the light at the point a was increased by the light at b, it would become equal to the full moon light at e. And conceiving the same transfer to be made from every point of the hemispherical surface $hbik$ to their opposite points in the hemisphere $kach$, the former hemisphere would be left quite dark, and the latter would be uniformly illuminated with full moon light; arising from a quantity of the sun's light, which immediately before its incidence on the moon, would uniformly illuminate a circular plane equal to a great circle of her body, called her *disk*. Therefore the quantities of light being the same upon both surfaces, the density of the sun's incident light is to the density of full moon light, as that hemispherical surface hek is to the said disk; that is, as any other hemispherical surface whose centre is at the eye, to that part of it which the moon's disk appears to possess very nearly, because it subtends but a small angle at the eye: that is, as radius of the hemisphere to the versed sine of the moon's apparent semidiameter, or as 10,000,000 to $1106\frac{2}{7}$ or as 90,400 to 1; taking the moon's mean horizontal diameter to be $16' 7''$.

"Strictly speaking, this rule compares moon light at the earth with day light at the moon; the medium of which, at her quadratures, is the same as our day-light; but is less at her full in the duplicate ratio of 365 to 366, or thereabout, that is, of the sun's distances from the earth and full moon; and therefore full moon light would be to our day light as about 1 to 90,900, if no rays were lost at the moon.

"Secondly, I say that full moon light is to any other moon light as the whole disk of the moon to the part that appears enlightened, considered upon a plane surface. For now let the earth be at b, and let dl be perpendicular to fg, and gm to cd: then it is plain, that gl is equal to dm; and that gl is equal to a perpendicular section of the sun's rays incident upon the arch dg which at b appears equal to dm; the eye being unable to distinguish the unequal distances of its parts. In like manner, conceiving the moon's surface to consist of innumerable physical circles parallel to $cfdg$, as represented at A, the same reason holds for every one of these circles as for $cfdg$. It follows then, that the bright part of the surface visible at b, when reduced to a flat as represented at B, by the crescent $pdqmp$, will be equal and similar to a perpendicular section of all the rays incident on that part, represented at C by the crescent $pgqlp$. Now the whole disk being in proportion to this crescent as the quantities of light incident upon them; and the light falling upon every rough particle, being equally rarefied in diverging to the eye at b, considered as equidistant from them all; it follows, that full moon light is to this moon light as the whole disk $pdqc$ to the crescent $pdqmp$. Fig. 9.

"Therefore by compounding this ratio with that in the former remark, day-light is to moon-light as the surface of an hemisphere whose centre is at the eye, to the part of that surface which appears to be possessed by the enlightened part of the moon."

272 Mr Michell's calculation.

Mr Michell made his computation in a much more simple and easy manner, and in which there is much less danger of falling into any mistake. Considering the distance of the moon from the sun, and that the density of the light must decrease in the proportion of the square of that distance, he calculated the density of the sun's light, at that distance, in proportion to its density at the surface of the sun; and in this manner he found, that if the moon reflected all the light it receives from the sun, it would only be the 45,000th part of the light we receive from the greater luminary. Admitting, therefore, that moon-light is only a 300,000th part of the light of the sun, Mr Michell concludes, that it reflects no more than between the 6th and 7th part of what falls upon it.

273 Rumford's photometer.

Could Rumford, has constructed a *photometer*, in which the shadows, instead of being thrown upon a paper spread out upon the wainscot, or side of the room, are projected upon the inside of the back part

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of a wooden box $7\frac{1}{4}$ inches wide, $10\frac{1}{2}$ inches long, and $3\frac{1}{4}$ inches deep, in the clear. The light is admitted into it through two horizontal tubes in the front, placed so as to form an angle of 60°; their axes meeting at the centre of the field of the instrument. In the middle of the front of the box, between these two tubes, is an opening through which is viewed the field of the photometer (see fig. 5.). This field is formed of a piece of white paper, which is not fastened immediately upon the inside of the back of the box, but is pasted upon a small pane of very fine ground glass; and this glass, thus covered, is let down into a groove, made to receive it, in the back of the box. The whole inside of the box, except the field of the instrument, is painted of a deep black dead colour. To the under part of the box is fitted a ball and socket, by which it is attached to a stand which supports it; and the top or lid of it is fitted with hinges, in order that the box may be laid quite open, as often as it is necessary to alter any part of the machinery it contains.

Plate CCCLXXXIX. fig. 5.

The count had found it very inconvenient to compare two shadows projected by the same cylinder, as these were either necessarily too far from each other to be compared with certainty, or, when they were nearer, were in part hid from the eye by the cylinder. To remedy this inconvenience, he now makes use of two cylinders, which are placed perpendicularly in the bottom of the box just described, in a line parallel to the back part of it, distant from this back $2\frac{2}{10}$ inches, and from each other 3 inches, measuring from the centres of the cylinders; when the two lights made use of in the experiment are properly placed, these two cylinders project four shadows upon the white paper upon the inside of the back part of the box, or the *field* of the instrument; two of which shadows are in contact, precisely in the middle of that field; and it is these two alone that are to be attended to. To prevent the attention being distracted by the presence of unnecessary objects, the two outside shadows are made to disappear; which is done by rendering the field of the instrument so narrow, that they fall without it, upon a blackened surface, upon which they are not visible. If the cylinders be each $\frac{4}{10}$ of an inch in diameter, and $2\frac{2}{10}$ inches in height, it will be quite sufficient that the field be $2\frac{7}{10}$ inches wide; and as an unnecessary height of the field is not only useless, but disadvantageous, as a large surface of white paper not covered by the shadows produces too strong a glare of light, the field ought not to be more than $\frac{1}{10}$ of an inch higher than the tops of the cylinders. That its dimensions, however, may be occasionally augmented, the covered glass should be made $5\frac{1}{2}$ inches long, and as wide as the box is deep, viz. $3\frac{1}{4}$ inches; since the field of the instrument can be reduced to its proper size by a screen of black pasteboard, interposed before the anterior surface of this covered glass, and resting immediately upon it. A hole in this pasteboard, in the form of an oblong square, $1\frac{7}{10}$ inch wide, and two inches high, determines the dimensions, and forms the boundaries of the field. This screen should be large enough to cover the whole inside of the back of the box, and it may be fixed in its place by means of grooves in the sides of the box, into which it may be made to enter. The position of the opening above mentioned is determined by the height of the cylinders; the top of it being $\frac{1}{10}$ of an inch higher than the tops of the cylinders; and as the height of it is only two inches, while the height of the cylinders is $2\frac{2}{10}$ inches, it is evident that the shadows of the lower parts of the cylinders do not enter the field. No inconvenience arises from that circumstance; on the contrary, several advantages are derived from that arrangement.

That the lights may be placed with facility and precision, a fine black line is drawn through the middle of the field, from the top to the bottom of it, and another (horizontal) line at right angles to it, at the height of the top of the cylinders. When the tops of the shadows touch this last mentioned line, the lights are at a proper height; and farther, when the two shadows are in contact with each other in the middle of the field, the lights are then in their proper directions.

We have said that the cylinders, by which the shadows are projected, are placed perpendicularly in the bottom of the box; but as the diameters of the shadows of these cylinders vary in some degree, in proportion as the lights are broader or narrower, and as they are brought nearer to or removed farther from the photometer, in order to be able in all cases to bring these shadows to be of the same diameter, which is very advantageous, in order to judge with greater facility and certainty when they are of the same density, the count renders the cylinders moveable about their axes, and adds to each a vertical wing $\frac{5}{10}$ of an inch wide, $\frac{1}{10}$ of an inch thick, and of equal height with the cylinder itself, and firmly fixed to it from the top to the bottom. This wing commonly lies in the middle of the shadow of the cylinder, and as long as it remains in that situation it has no effect whatever; but when it is necessary that the diameter of one of the shadows be increased, the corresponding cylinder is moved about its axis, till the wing just described, emerging out of the shadow, and intercepting a portion of light, brings the shadow projected upon the field of the instrument to be of the width or diameter required. In this operation it is always necessary to turn the cylinder outwards, or in such a manner that the augmentation of the width of the shadow may take place on that side of it which is opposite to the shadow corresponding to the other light. The necessity for that precaution will appear evident to any one who has a just idea of the instrument in question, and of the manner of making use of it. They are turned likewise without opening the box, by taking hold of the ends of their axes, which project below its bottom.

As it is absolutely necessary that the cylinders should constantly remain precisely perpendicular to the bottom of the box, or parallel to each other, it will be best to construct them of brass; and, instead of fixing them immediately to the bottom of the box (which, being of wood, may warp), to fix them to a strong thick piece of well-hammered plate brass; which plate of brass may be afterwards fastened to the bottom of the box by means of one strong screw. In this manner two of the count's best instruments are constructed; and, in order to secure the cylinders still more firmly in their vertical positions, they are furnished with broad flat rings, or projections, where they rest upon the brass plate; which rings are $\frac{1}{10}$ of an inch thick, and equal in diameter to the projection of the wing of the cylinder, to the bottom of which they afford a firm support. These cylinders are likewise forcibly pushed, or rather pulled, against

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against the brass plate upon which they rest, by means of compressed spiral springs placed between the under side of that plate and the lower ends of the cylinders. Of whatever material the cylinders be constructed, and whatever be their forms or dimensions, it is absolutely necessary that they, as well as every other part of the photometer, except the field, should be well painted of a deep black dead colour.

In order to move the lights to and from the photometer with greater ease and precision, the observer should provide two long and narrow, but very strong and steady, tables; in the middle of each of which there is a straight groove, in which a sliding carriage, upon which the light is placed, is drawn along by means of a cord which is fastened to it before and behind, and which, passing over pulleys at each end of the table, goes round a cylinder; which cylinder is furnished with a winch, and is so placed, near the end of the table adjoining the photometer, that the observer can turn it about, without taking his eye from the field of the instrument.

Many advantages are derived from this arrangement: First, the observer can move the lights as he finds necessary, without the help of an assistant, and even without removing his eye from the shadows; secondly, each light is always precisely in the line of direction in which it ought to be, in order that the shadows may be in contact in the middle of the vertical plane of the photometer; and, thirdly, the sliding motion of the lights being perfectly soft and gentle, that motion produces little or no effect upon the lights themselves, either to increase or diminish their brilliancy.

These tables must be placed at an angle of 60 degrees from each other, and in such a situation, with respect to the photometer, that lines drawn through their middles, in the direction of their lengths, meet in a point exactly under the middle of the vertical plane or field of the photometer, and from that point the distances of the lights are measured; the sides of the tables being divided into English inches, and a vernier, shewing tenths of inches, being fixed to each of the sliding carriages upon which the lights are placed, and which are so contrived that they may be raised or lowered at pleasure; so that the lights may be always in a horizontal line with the tops of the cylinders of the photometer.

In order that the two long and narrow tables or platforms, just described, may remain immoveable in their proper positions, they are both firmly fixed to the stand which supports the photometer; and, in order that the motion of the carriages which carry the lights may be as soft and gentle as possible, they are made to slide upon parallel brass wires, 9 inches asunder, about $\frac{1}{10}$ of an inch in diameter, and well polished, which are stretched out upon the tables from one end to the other.

Plate CCLXXXIX. fig 5.

The structure of the apparatus will be clearly understood by a bare inspection of Plate CCLXXXIX. Fig. 5. is a plan of the inside of the box, and the adjoining parts of the photometer. Fig. 6. Plan of the two tables belonging to the photometer. Fig. 7. The box of the photometer on its stand. Fig. 8. Elevation of the photometer, with one of the tables and carriages.

Having sufficiently explained all the essential parts of this photometer, it remains for us to give some account of the precautions necessary to be observed in using it. And, first, with respect to the distance at which lights, whose intensities are to be compared, should be placed from the field of the instrument, the ingenious and accurate inventor found, that when the weakest of the lights in question is about as strong as a common wax candle, that light may most advantageously be placed from 30 to 36 inches from the centre of the field; and when it is weaker or stronger, proportionally nearer or farther off. When the lights are too near, the shadows will not be well defined; and when they are too far off, they will be too weak.

It will greatly facilitate the calculations necessary in drawing conclusions from experiments of this kind, if some steady light, of a proper degree of strength for that purpose, be assumed as a standard by which all others may be compared. Our author found a good Argand's lamp much preferable for this purpose to any other lamp or candle whatever. As it appears, he says, from a number of experiments, that the quantity of light emitted by a lamp, which burns in the same manner with a clear flame, and *without smoke*, is in all cases as the quantity of oil consumed, there is much reason to suppose, that, if the Argand's lamp be so adjusted as always to consume a given quantity of oil in a given time, it may then be depended on as a just standard of light.

In order to abridge the calculation necessary in these inquiries, it will always be advantageous to place the standard-lamp at the distance of 100 inches from the photometer, and to assume the intensity of its light at its source equal to unity; in this case (calling this standard light A, the intensity of the light at its source $=x=1$, and the distance of the lamp from the field of the photometer $=m=100$), the intensity of the illumination at the field of the photometer $\left(=\frac{x}{m^2}\right)$ will be expressed by the fraction $\frac{1}{100^2}=\frac{1}{10000}$; and the relative intensity of any other light which is compared with it, may be found by the following proportion: Calling this light B, putting $y=$ its intensity at its source, and $n=$ its distance from the field of the photometer, expressed in English inches, as it is $\frac{y}{n^2}=\frac{x}{m^2}$, or, instead of $\frac{x}{m^2}$, writing its value $=\frac{1}{10000}$, it will be $\frac{y}{n^2}=\frac{1}{10000}$; and consequently y is to 1 as n^2 is to 10000; or the intensity of the light B at its source, is to the intensity of the standard light A at its source, as the square of the distance of the light B from the middle of the field of the instrument, expressed in inches, is to 10000; and hence it is $y=\frac{n^2}{10000}$.

Or, if the light of the sun, or that of the moon, be compared with the light of a given lamp or candle C, the result of such comparison may be best expressed in words, by saying, that the light of the celestial luminary in question, *at the surface of the earth*, or, which is the same thing, at the field of the photometer, is equal to the light of the given lamp or candle, *at the distance found by the experiment*; or, putting $a=$ the intensity of the light of this lamp C at its source, and $p=$ its distance,

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distance, in inches, from the field, when the shadows corresponding to this light, and that corresponding to the celestial luminary in question, are found to be of equal densities, and putting $z=$ the intensity of the rays of the luminary at the surface of the earth, the result of the experiment may be expressed thus, $z=\frac{a}{p^2}$; or the real value of a being determined by a particular experiment, made expressly for that purpose with the standard lamp, that value may be written instead of it. When the standard lamp itself is made use of, instead of lamp C, then the value of A will be 1.

The count's first attempts with his photometer were to determine how far it might be possible to ascertain, by direct experiments, the certainty of the assumed law of the diminution of the intensity of the light emitted by luminous bodies; namely, that the intensity of the light is everywhere as the squares of the distances from the luminous body inversely. As it is obvious that this law can hold good only when the light is propagated through perfectly transparent spaces, so that its intensity is weakened merely by the divergency of its rays, he instituted a set of experiments to ascertain the transparency of the air and other mediums.

With this view, two equal wax candles, well trimmed, and which were found, by a previous experiment, to burn with exactly the same degree of brightness, were placed *together*, on one side, before the photometer, and their united light was counterbalanced by the light of an Argand's lamp, well trimmed, and burning very equally, placed on the other side over against them. The lamp was placed at the distance of 100 inches from the field of the photometer, and it was found that the two burning candles (which were placed as near together as possible, without their flames affecting each other by the currents of air they produced) were just able to counterbalance the light of the lamp at the field of the photometer, when they were placed at the distance of 60.8 inches from that field. One of the candles being now taken away and extinguished, the other was brought nearer to the field of the instrument, till its light was found to be just able, singly, to counterbalance the light of the lamp; and this was found to happen when it had arrived at the distance of 43.4 inches. In this experiment, as the candles burnt with equal brightness, it is evident that the intensities of their united and single lights were as 2 to 1, and in that proportion ought, according to the assumed theory, the squares of the distances, 60.8 and 43.4, to be; and, in fact, $\overline{60.8}^2=3696.64$ is to $\overline{43.4}^2=1883.56$ as 2 is to 1 very nearly.

Again, in another experiment, the distances were,

With two candles = 54 inches. Square = 2916
With one candle = 38.6 - = 1489.96

Upon another trial,

With two candles = 54.6 inches. Square = 2981.16
With one candle = 39.7 - = 1576.09

And, in the fourth experiment,

With two candles = 58.4 inches. Square = 3410.56
With one candle = 42.2 - - = 1780.84

And, taking the mean of the results of these four experiments,

	Squares of the distances With two candles.		With one candle.
In the experiment N° 1.	3696.64	—	1883.56
N° 2.	2916	—	1489.96
N° 3.	2981.16	—	1576.09
N° 4.	3410.56	—	1780.84
	4)13004.36		4)6730.45
Means	3251.09	and	1682.61

which again are very nearly as 2 to 1.

With regard to these experiments, it may be observed, that were the resistance of the air to light, or the diminution of the light from the imperfect transparency of air, sensible within the limits of the inconsiderable distances at which the candles were placed from the photometer, in that case the distance of the two equal lights united ought to be, to the distance of one of them single, in a ratio less than that of the square root of 2 to the square root of 1. For if the intensity of a light emitted by a luminous body, *in a space void of all resistance*, be diminished in the proportion of the squares of the distances, it must of necessity be diminished in a still higher ratio when the light passes through a resisting medium, or one which is not perfectly transparent; and from the difference of those ratios, namely, that of the squares of the distances, and that other higher ratio found by the experiment, the resistance of the medium might be ascertained. This he took much pains to do with respect to air, but did not succeed; the transparency of air being so great, that the diminution which light suffers in passing through a few inches, or even through several feet of it, is not sensible.

Having found, upon repeated trials, that the light of a lamp, properly trimmed, is incomparably more equal than that of a candle, whose wick, continually growing longer, renders its light extremely fluctuating, he substituted lamps to candles in these experiments, and made such other variations in the manner of conducting them as he thought bid fair to lead to a discovery of the resistance of the air to light, were it possible to render that resistance sensible within the confined limits of his machinery. But the results of them, so far from affording means for ascertaining the resistance of the air to light, do not even indicate any resistance at all; on the contrary, it might almost be inferred, from some of them, that the intensity of the light emitted by a luminous body in air is diminished in a ratio *less* than that of the squares of the distances; but as such a conclusion would involve an evident absurdity, namely, that light moving in air, its absolute quantity, instead of being diminished, actually goes on to *increase*, that conclusion can by no means be admitted.

Why not? Theories must give place to facts; and if this fact can be fairly ascertained, instead of rejecting the conclusion, we ought certainly to rectify our notions of light, the nature of which we believe no man fully comprehends. Who can take it upon him to say, that the substance of light is not latent in the atmosphere, as heat or caloric is now acknowledged to be latent, and that the agency of the former is not called forth by the passage of a ray through a portion of air, as the agency of the latter is known to be excited by

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by the combination of oxygen with any combustible substance?

The ingenious author's experiments all conspired to shew that the resistance of the air to light is too inconsiderable to be perceptible, and that the assumed law of the diminution of the intensity of light may be depended upon with safety. He admits, however, that means may be found for rendering the air's resistance to light apparent; and he seems to have thought of the very means which occurred for this purpose to M. de Saussure.

274 Contrivances of Saussure.

That eminent philosopher, wishing to ascertain the transparency of the atmosphere, by measuring the distances at which determined objects cease to be visible, perceived at once that his end would be attained, if he should find objects of which the disappearance might be accurately determined. Accordingly, after many trials, he found that the moment of disappearance can be observed with much greater accuracy when a black object is placed on a white ground, than when a white object is placed on a black ground: that the accuracy was still greater when the observation was made in the sun than in the shade; and that even a still greater degree of accuracy was obtained, when the white space surrounding a black circle, was itself surrounded by a circle or ground of a dark colour. This last circumstance was particularly remarkable, and an observation quite new.

If a circle totally black, of about two lines in diameter, be fastened on the middle of a large sheet of paper or pasteboard, and if this paper or pasteboard be placed in such a manner as to be exposed fully to the light of the sun, if you then approach it at the distance of three or four feet, and afterwards gradually recede from it, keeping your eye constantly directed towards the black circle, it will appear always to decrease in size the farther you retire from it, and at the distance of 33 or 34 feet will have the appearance of a point. If you continue still to recede, you will see it again enlarge itself; and it will seem to form a kind of cloud, the darkness of which decreases more and more according as the circumference becomes enlarged. The cloud will appear still to increase in size the farther you remove from it; but at length it will totally disappear. The moment of the disappearance, however, cannot be accurately ascertained: and the more experiments were repeated, the more were the results different.

M. de Saussure, having reflected for a long time on the means of remedying this inconveniency, saw clearly, that as long as this cloud took place, no accuracy could be obtained; and he discovered that it appeared in consequence of the contrast formed by the white parts which were at the greatest distance from the black circle. He thence concluded, that if the ground was left white near this circle, and the parts of the pasteboard at the greatest distance from it were covered with a dark colour, the cloud would no longer be visible, or at least almost totally disappear.

This conjecture was confirmed by experiment. M. de Saussure left a white space around the black circle equal in breadth to its diameter, by placing a circle of black paper a line in diameter, on the middle of a white circle three lines in diameter, so that the black circle was only surrounded by a white ring a line in breadth. The whole was pasted upon a green ground. A green colour was chosen, because it was dark enough to make the cloud disappear, and the easiest to be procured.

The black circle surrounded in this manner with white on a green ground, disappeared at a much less distance than when it was on a white ground of a large size.

If a perfectly black circle, a line in diameter, be pasted on the middle of a white ground exposed to the open light, it may be observed at the distance of from 44 to 45 feet; but if this circle be surrounded by a white ring a line in breadth, while the rest of the ground is green, all sight of it is lost at the distance of only $15\frac{1}{2}$ feet.

According to these principles M. de Saussure delineated several black circles, the diameters of which increased in a geometrical progression, the exponent of which was $\frac{3}{2}$. His smallest circle was $\frac{1}{5}$ or 0.2 of a line in diameter; the second, 0.3; the third, 0.45; and so on to the sixteenth, which was 87.527, or about 7 inches $3\frac{1}{2}$ lines. Each of these circles was surrounded by a white ring, the breadth of which was equal to the diameter of the circle, and the whole was pasted on a green ground.

M. de Saussure, for his experiments, selected a straight road or plain of about 1200 or 1500 feet in circumference, which towards the north was bounded by trees or an ascent. Those who repeat them, however, must pay attention to the following remarks: When a person retires backwards, keeping his eye constantly fixed on the pasteboard, the eye becomes fatigued, and soon ceases to perceive the circle; as soon therefore as it ceases to be distinguishable, you must suffer your eyes to rest; not, however, by shutting them, for they would when again opened be dazzled by the light, but by turning them gradually to some less illuminated object in the horizon. When you have done this for about half a minute, and again directed your eyes to the pasteboard, the circle will be again visible, and you must continue to recede till it disappear once more. You must then let your eyes rest a second time in order to look at the circle again, and continue in this manner till the circle becomes actually invisible.

If you wish to find an accurate expression for the want of transparency, you must employ a number of circles, the diameters of which increase according to a certain progression; and a comparison of the distances at which they disappear will give the law according to which the transparency of the atmosphere decreases at different distances. If you wish to compare the transparency of the atmosphere on two days, or in two different places, two circles will be sufficient for the experiment.

According to these principles, M. de Saussure caused to be prepared a piece of white linen cloth eight feet square. In the middle of this square he sewed a perfect circle, two feet in diameter, of beautiful black wool; around this circle he left a white ring two feet in breadth, and the rest of the square was covered with pale green. In the like manner, and of the same materials, he prepared another square; which was, however, equal to only $\frac{1}{11}$ of the size of the former, so that each side of it was 8 inches; the black circle in the middle was two inches in diameter, and the white space around the circle was 2 inches also.

If two squares of this kind be suspended vertically and

Apparatus for Measuring Light.

and parallel to each other, so that they may be both illuminated in an equal degree by the sun; and if the atmosphere, at the moment when the experiment is made, be perfectly transparent, the circle of the large square, which is twelve times the size of the other, must be seen at twelve times the distance. In M. de Saussure's experiments the small circle disappeared at the distance of 314 feet, and the large one at the distance of 3588 feet, whereas it should have disappeared at the distance of 3768. The atmosphere, therefore, was not perfectly transparent. This arose from the thin vapours which at that time were floating in it. M. de Saussure, calls his instrument a *diaphanometer;* but it serves one of the purposes of a photometer.

From a number of experiments made with the *photometer*, Count Rumford found, that, by passing through a pane of fine, clear, well polished glass, such as is commonly made use of in the construction of looking-glasses, light loses .1973 or its whole quantity, i. e. of the quantity which impinged on the glass; that when light is made to pass through two panes of such glass standing parallel, but not touching each other, the loss is .3184 of the whole; and that in passing through a very thin, clear, colourless pane of window-glass, the loss is only .1263. Hence he infers, that this apparatus might be very usefully employed by the optician, to determine the degree of transparency of glass, and direct his choice in the provision of that important article of his trade. The loss of light when reflected from the very best plain glass mirror, the author ascertained, by five experiments, to be ⅓d of the whole which fell upon the mirror.

275 Leslie's photometer. An ingenious photometer has also been invented by Professor Leslie, and fully described in his celebrated work on Heat, to which we must refer the reader for a complete description of this instrument. It measures the calorific effect of heat, and is founded upon this principle, "that if a body be exposed to the sun's rays, it will, in every possible case, be found to indicate a measure of heat exactly proportioned to the quantity of light which it has absorbed." See *Essay on Heat*, p. 103.

Chap. II. *On the method of forming the Lenses and Specula, of Refracting and Reflecting Telescopes.*

Sect. I. *On the Method of grinding and polishing Lenses.*

276 On grinding lenses. Having fixed upon the proper aperture and focal distance of the lens, take a piece of sheet copper, and strike a fine arch upon its surface, with a radius equal to half that distance, if it is to be plano-convex, and let the length of this arch be a little greater than the given aperture. Remove with a file that part of the copper which is without the circular arch, and a *convex gage* will be formed. Strike another arch with the same radius, and having removed that part of the copper which is within it, a *concave gage*, will be obtained.

Method of Grinding and Polishing Lenses.

277 Formation of the gages. Prepare two circular plates of brass, about $\frac{1}{10}$ of an inch thick, and half an inch greater in diameter than the breadth of the lens, and solder them upon a cylinder of lead of the same diameter, and about an inch high.

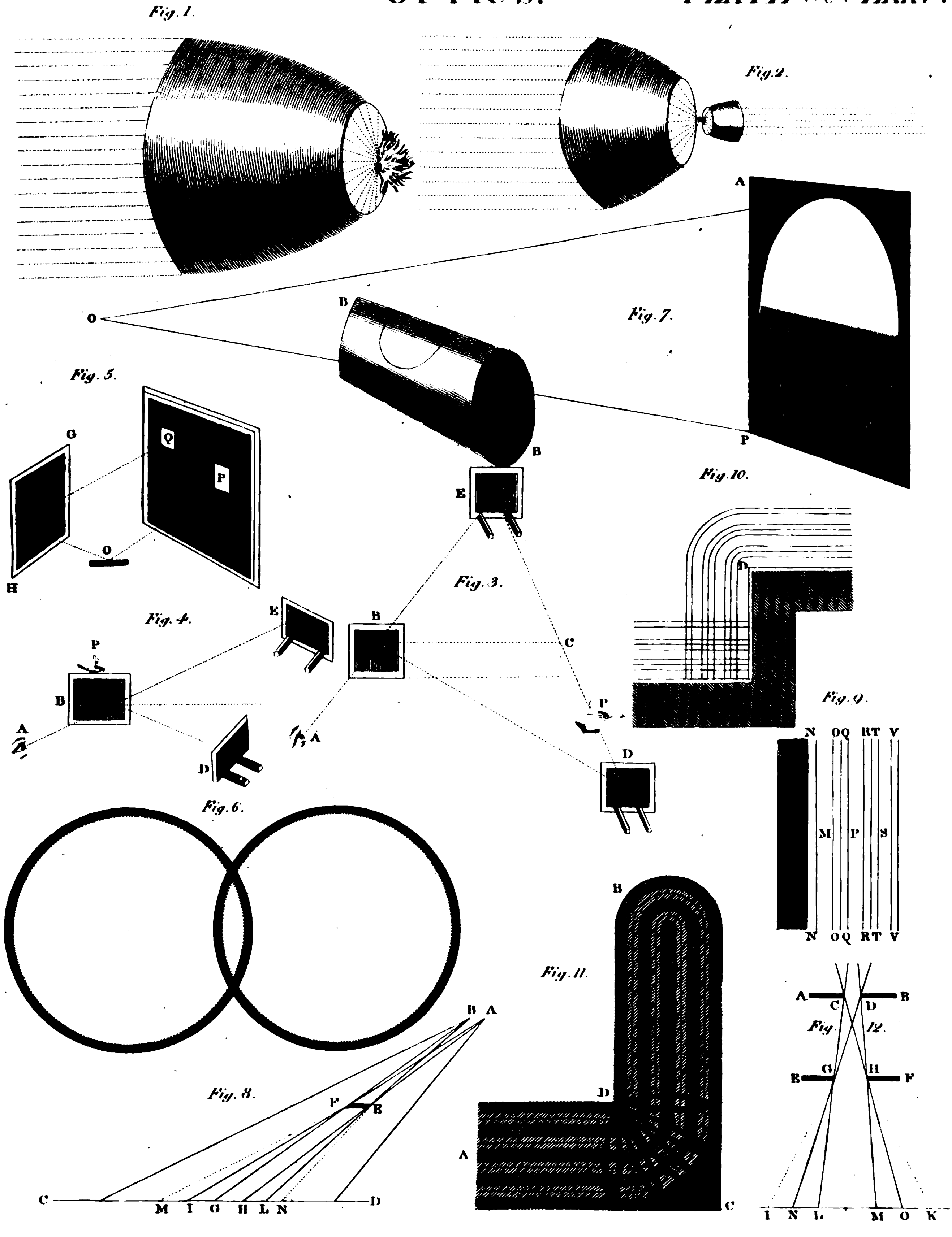
278 Formation of the tools. These tools are then to be fixed upon a turning lathe, and one of them turned into a portion of a concave sphere, so as to suit the convex gage; and the other into a portion of a convex sphere, so as to answer the concave gage. After the surfaces of the brass plates are turned as accurately as possible, they must be ground upon one another, alternately, with flour emery; and when the two surfaces exactly coincide, the grinding tools will be ready for use.

279 Formation of the glass. Procure a piece of glass whose dispersive power is as small as possible, if the lens is not for achromatic instruments, and whose surfaces are parallel; and by means of a pair of large scissars or pincers, cut it into a circular shape, so that its diameter may be a little greater than the required aperture of the lens. When the roughness is removed from its edges by a common grindstone (A), it is to be fixed with black pitch to a wooden handle of a smaller diameter than the glass, and about an inch high, so that the centre of the handle may exactly coincide with the centre of the glass.

280 Mode of grinding. The glass being thus prepared, it is then to be ground with fine emery upon the concave tool, if it is to be convex, and upon the convex tool, if it is to be concave. To avoid circumlocution, we shall suppose that the lens is to be convex. The concave tool, therefore, which is to be used, must be firmly fixed to a table or bench, and the glass wrought upon it with circular strokes, so that its centre may never go beyond the edges of the tool. For every 6 circular strokes, the glass should receive 2 or 3 cross ones along the diameter of the tool, and in different directions. When the glass has received its proper shape, and touches the tool in every point of its surface, which may be easily known by inspection, the emery is to be washed away, and finer kinds (B) successively substituted in its room, till by the same alternation of circular and transverse strokes, all the scratches and asperities are removed from its surface. After the finest emery has been used, the roughness which remains may be taken away, and a slight polish superinduced by grinding the glass with pounded pumice-stone in the same manner as before. While the operation of grinding is going on, the convex tool should, at the end of every five

(A) When the focal distance of the lens is to be short, the surface of the piece of glass should be ground upon a common grindstone, so as to suit the gage as nearly as possible; and the plates of brass, before they are soldered on the lead, should be hammered as truly as they can be done into their proper form. By this means much labour will be saved both in turning and grinding.

(B) Emery of different degrees of fineness may be made in the following manner. Take five or six clean vessels, and having filled one of them with water, put into it a considerable quantity of flour emery. Stir it well with a piece of wood, and after standing for 5 seconds pour the water into the second vessel. After it has stood about 12 seconds, pour it out of this into a third vessel, and so on with the rest; and at the bottom of each vessel will be found emery of different degrees of fineness, the coarsest being in the first vessel, and the finest in the last.



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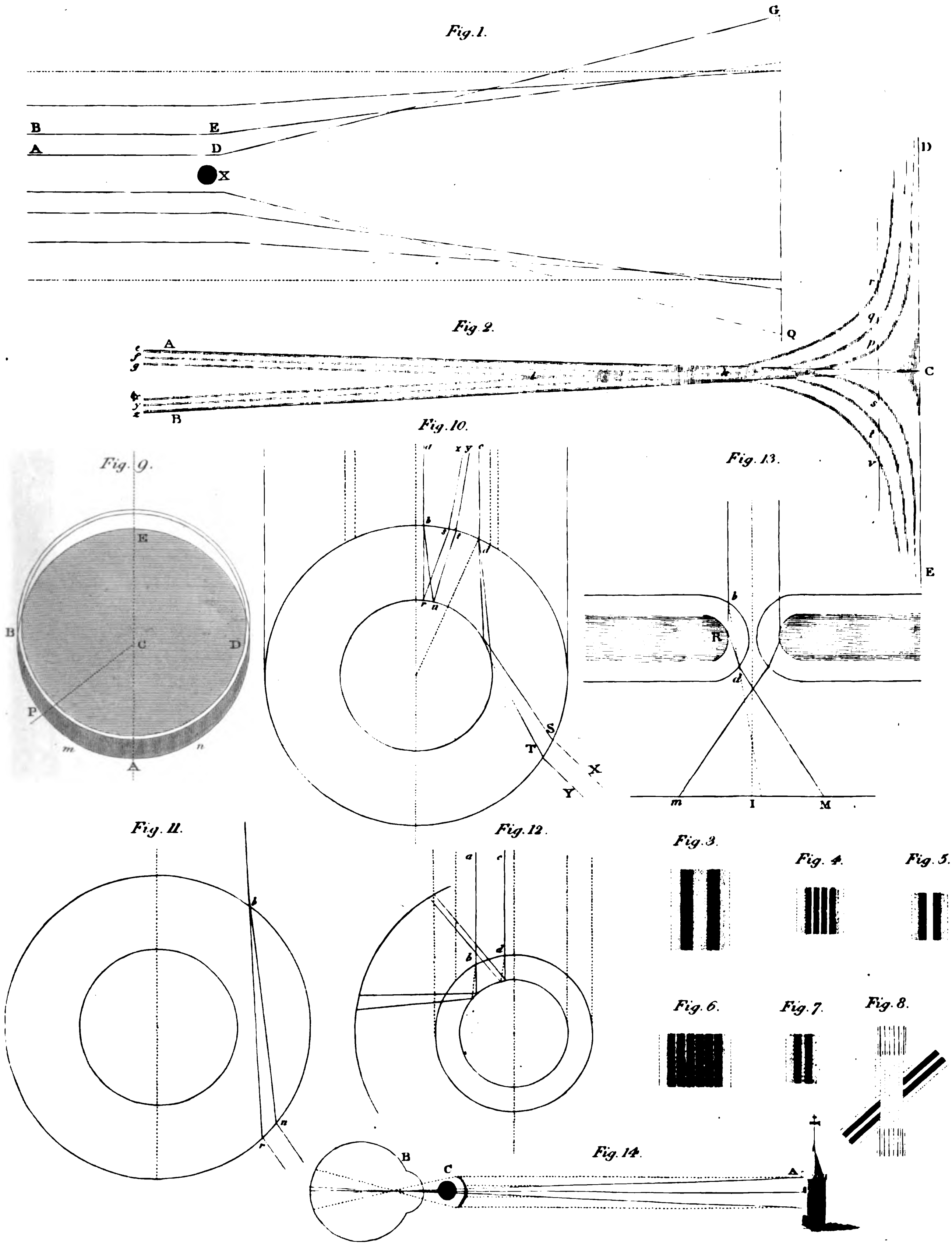

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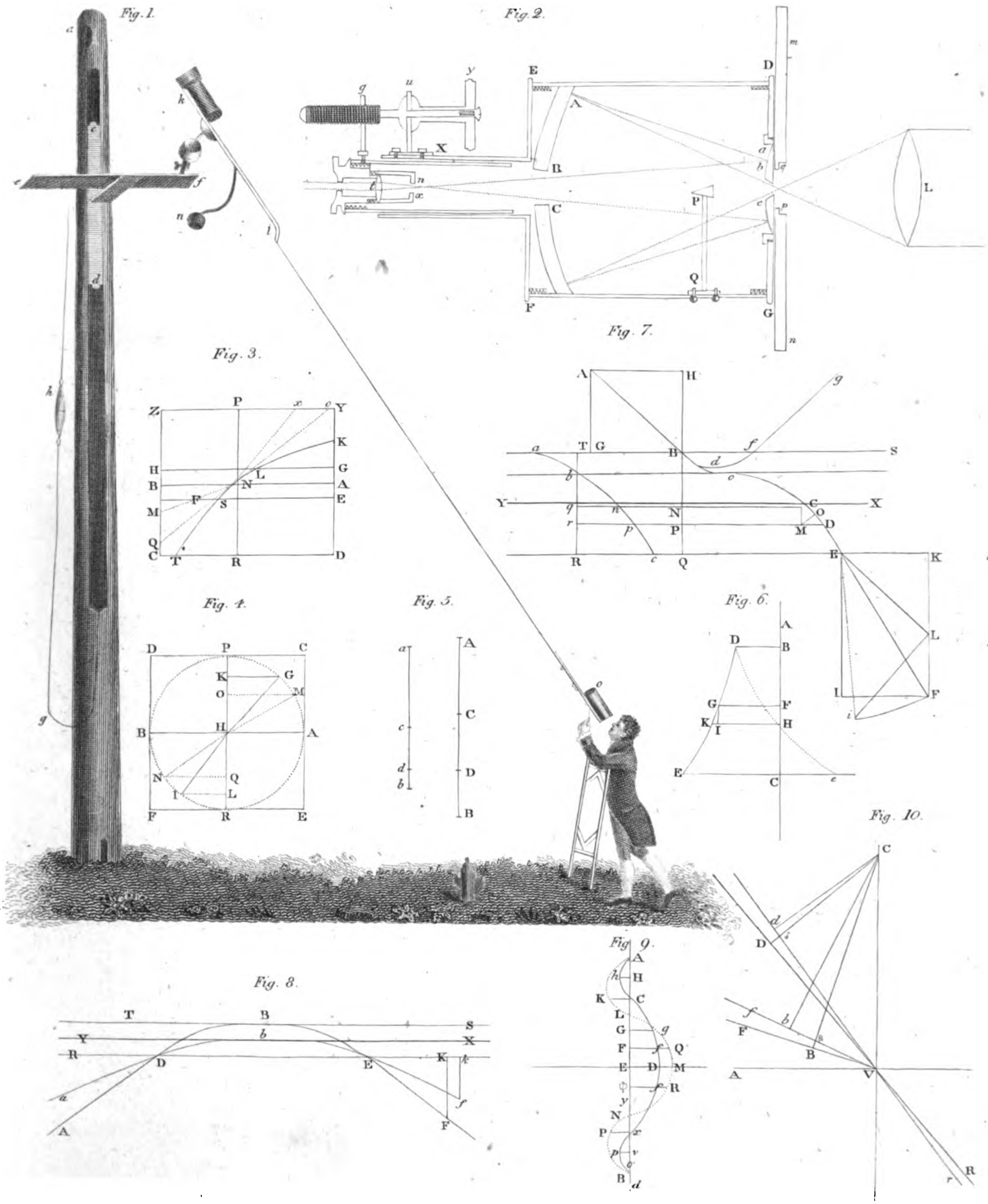

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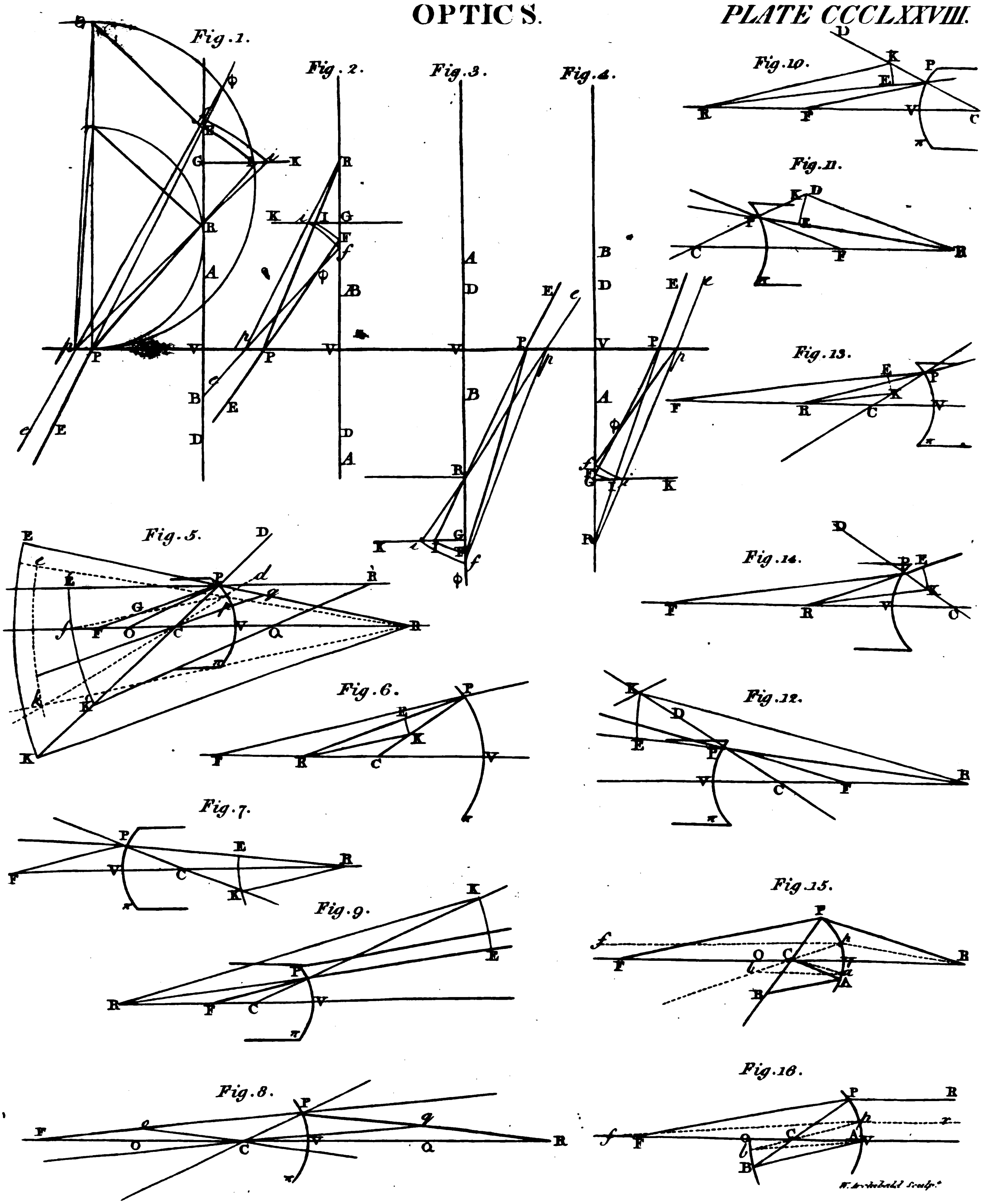
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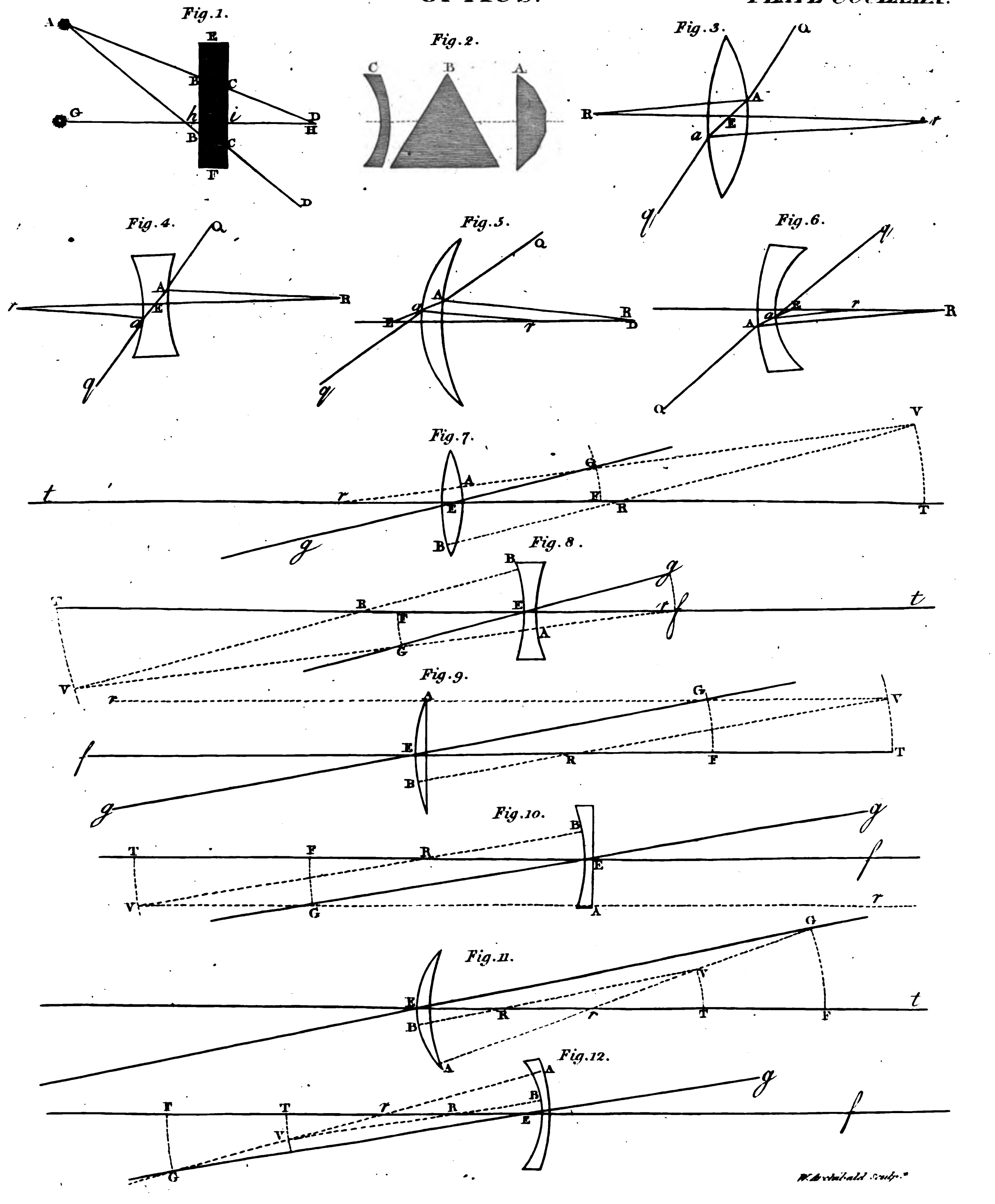

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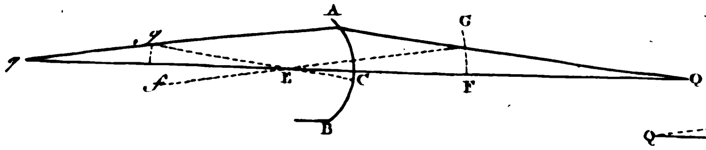

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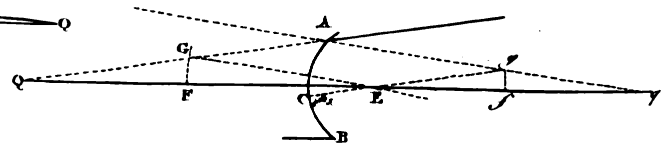

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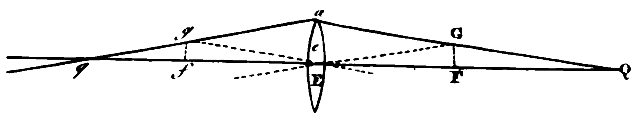

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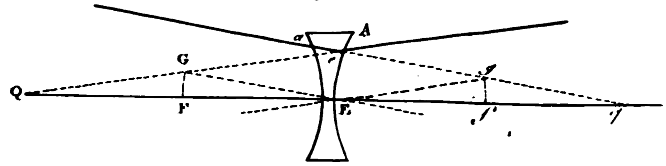

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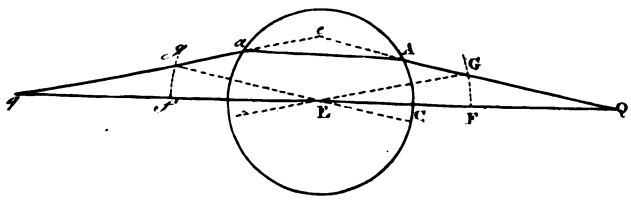

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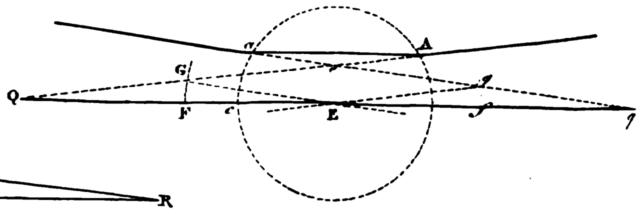

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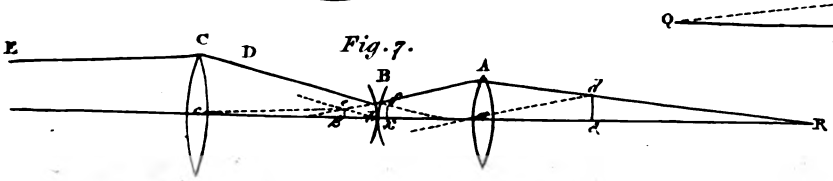

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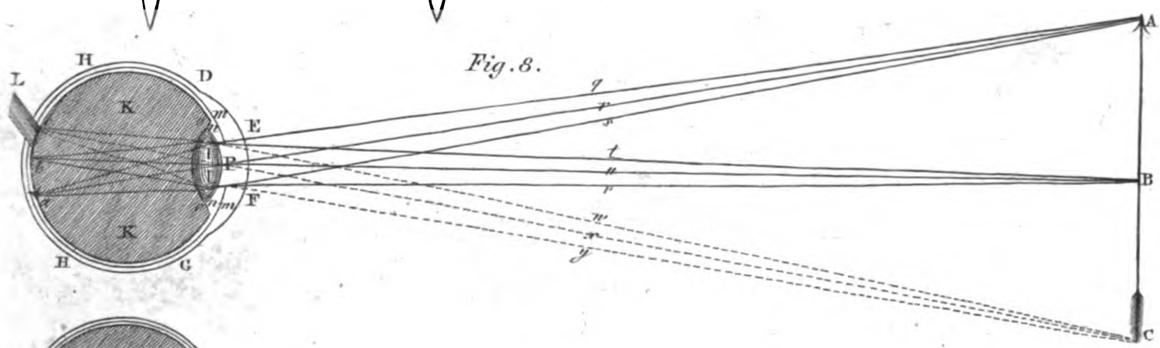

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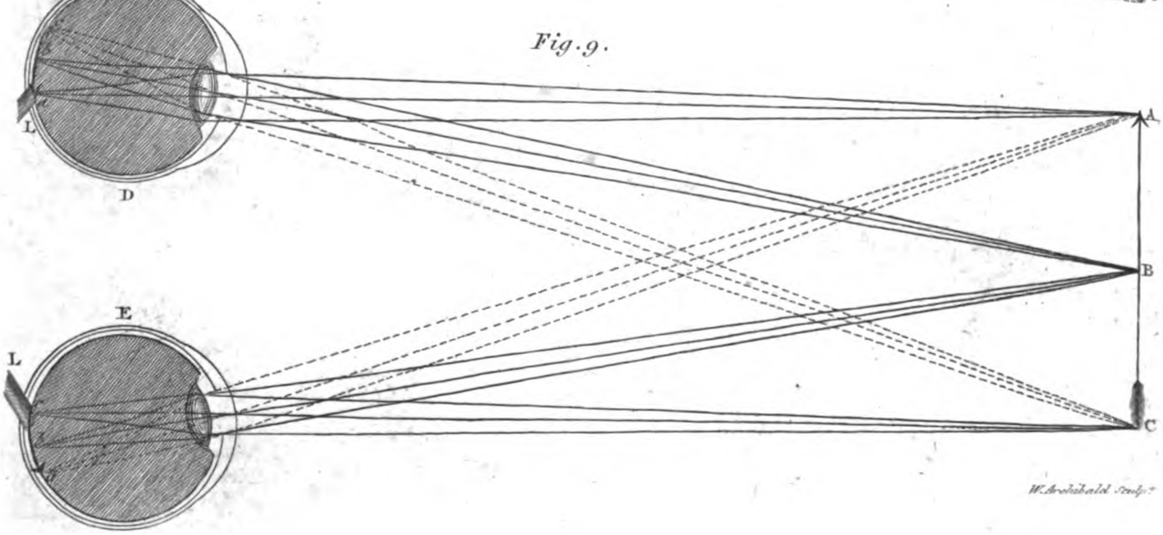

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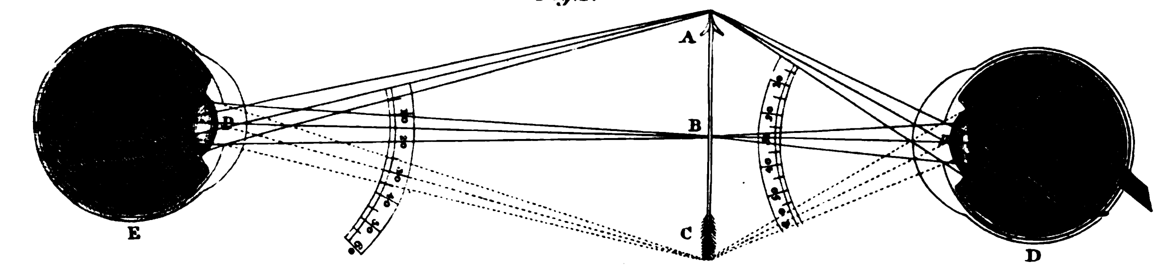

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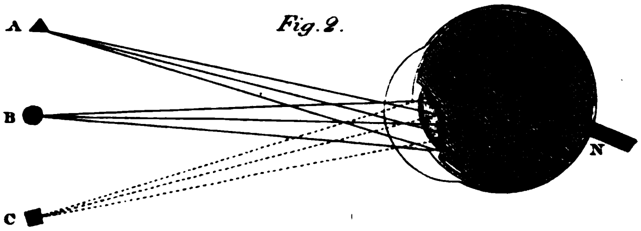

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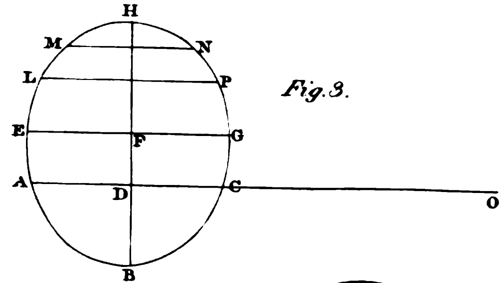

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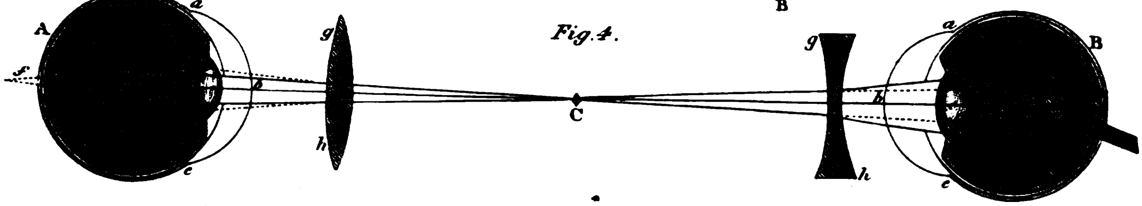

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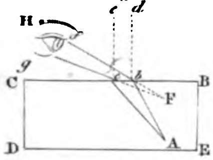

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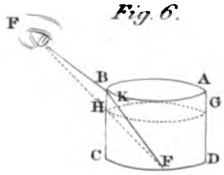

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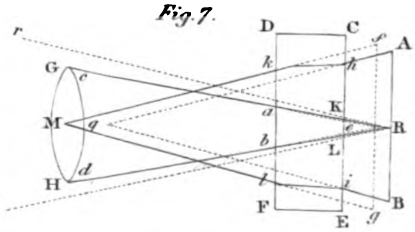

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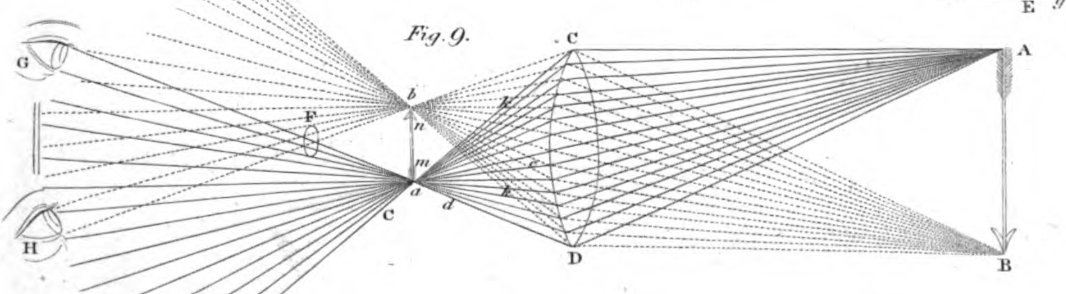

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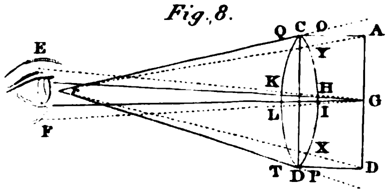

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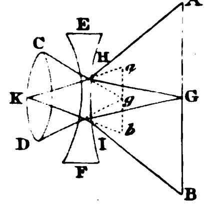

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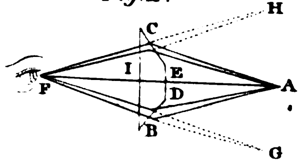

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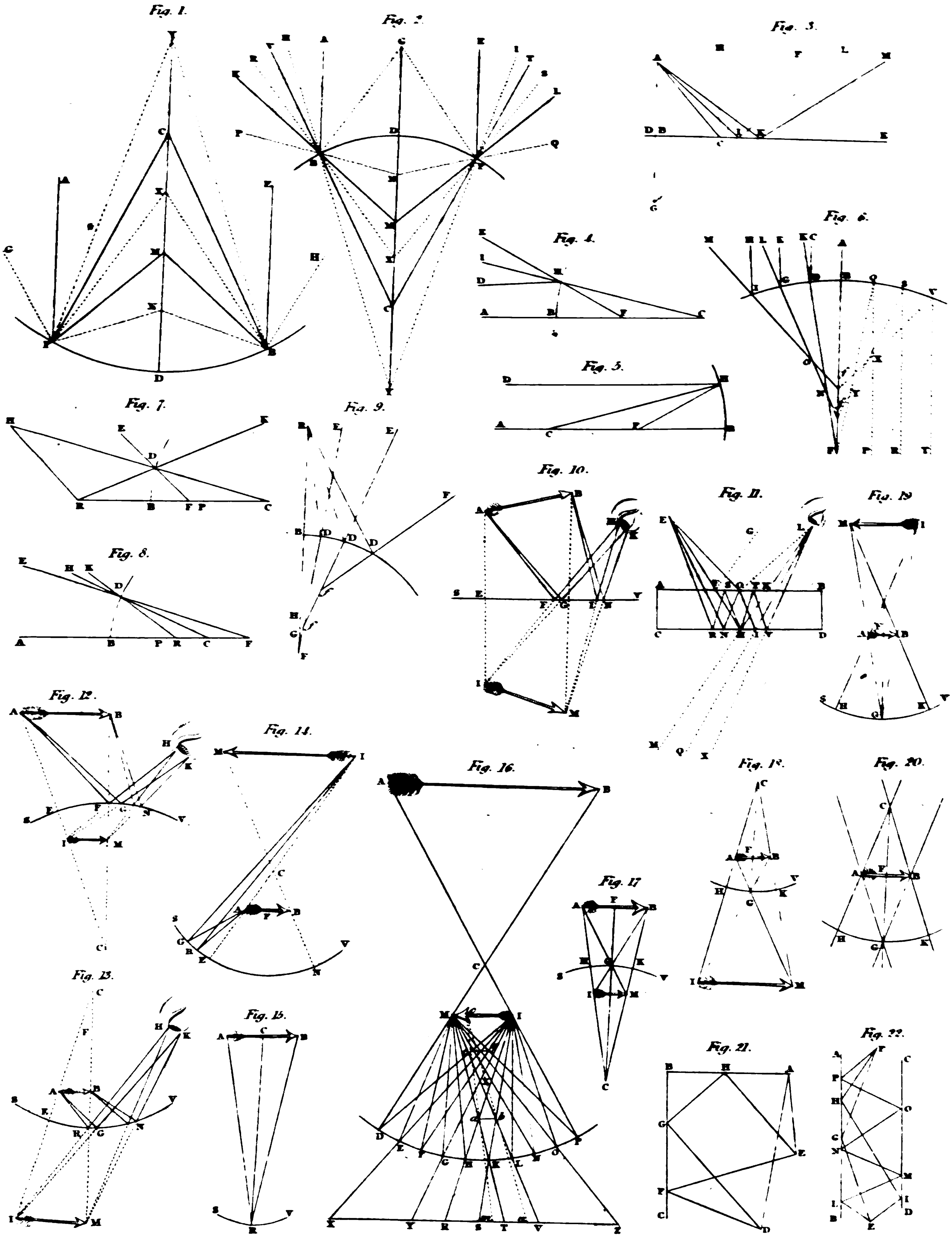
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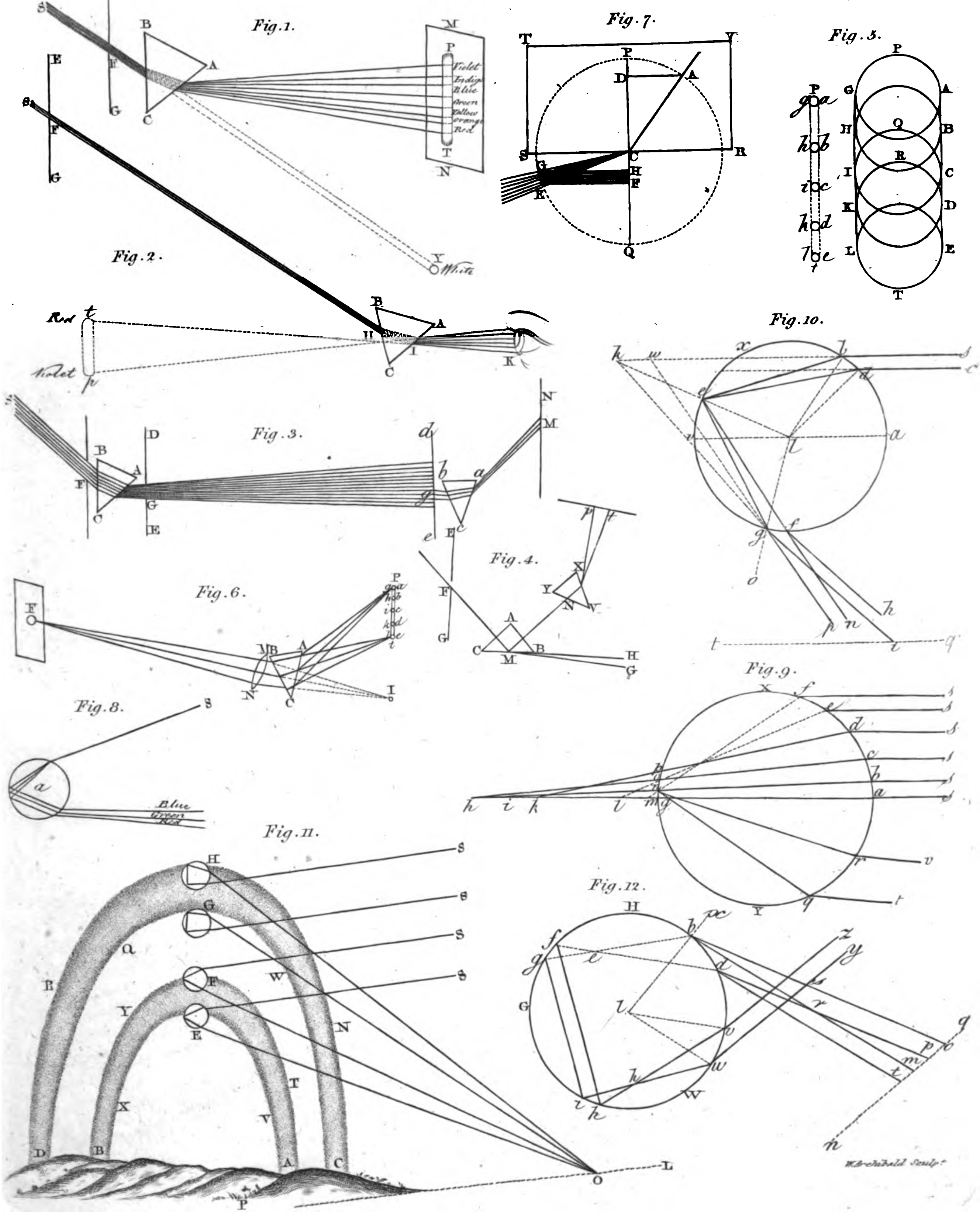
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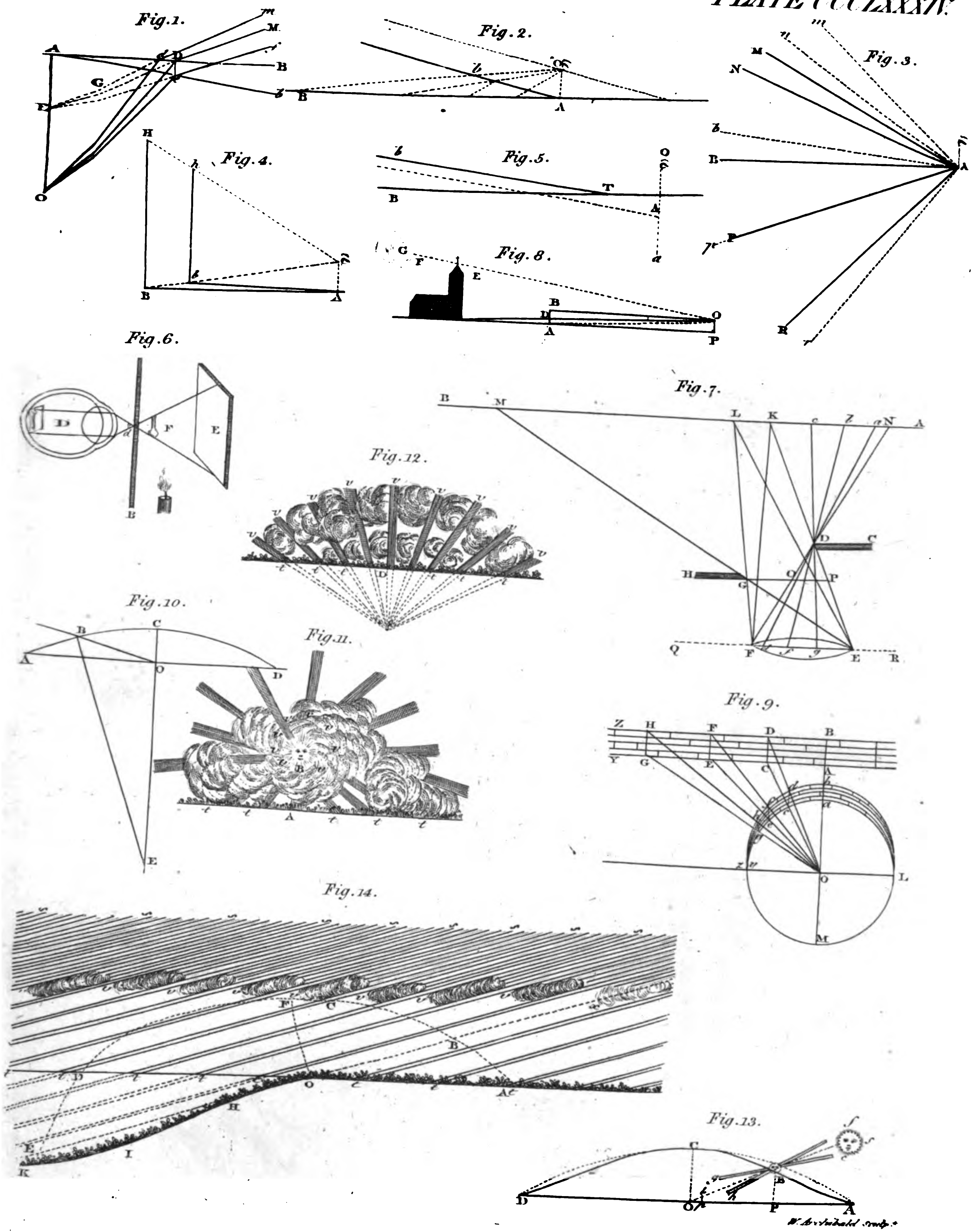
W. Archibald Sculp.

OPTICS. PLATE CCCLXXXIV.



OPTICS.

PLATE CCCLXXXV.

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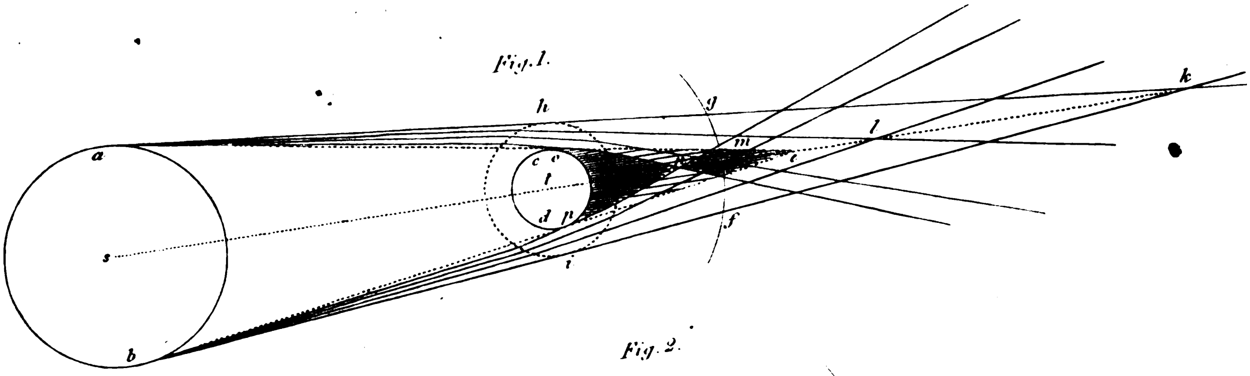

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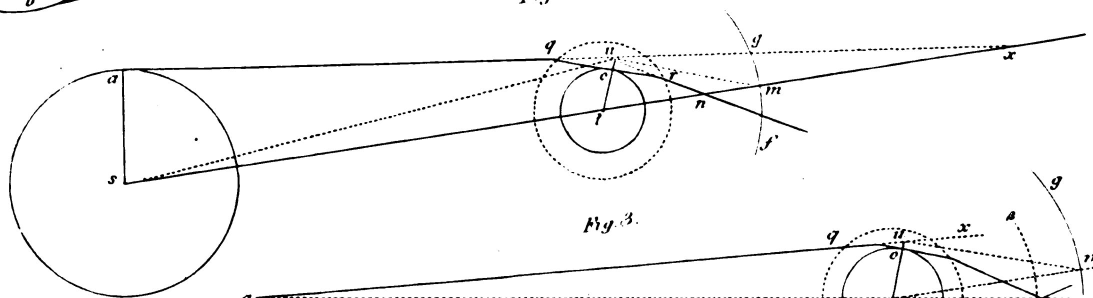

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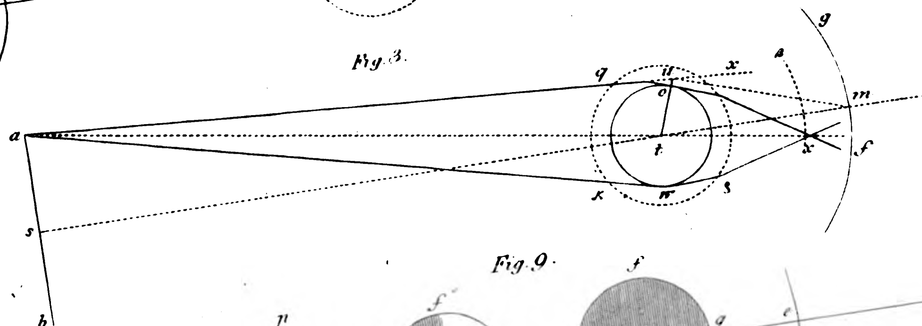

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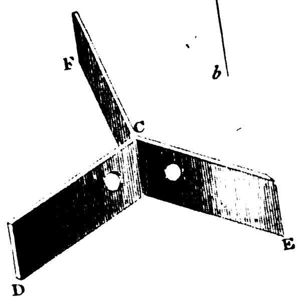

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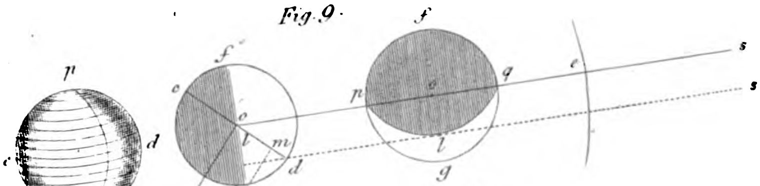

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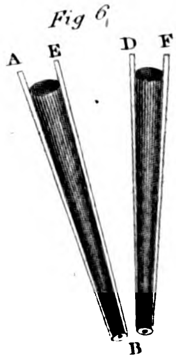

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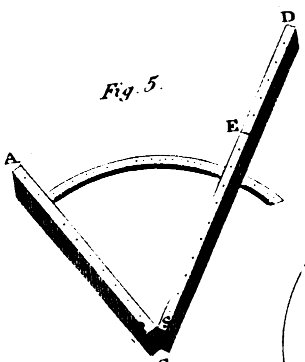

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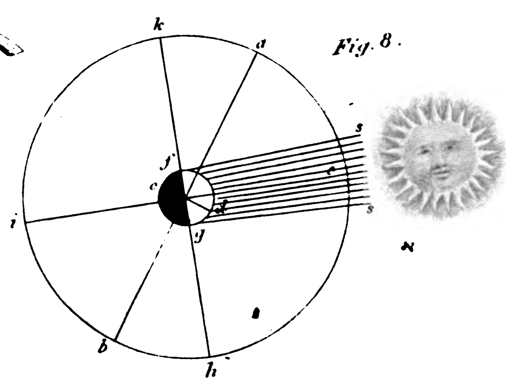

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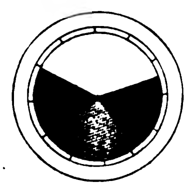

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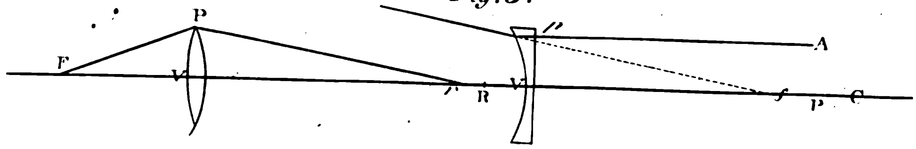

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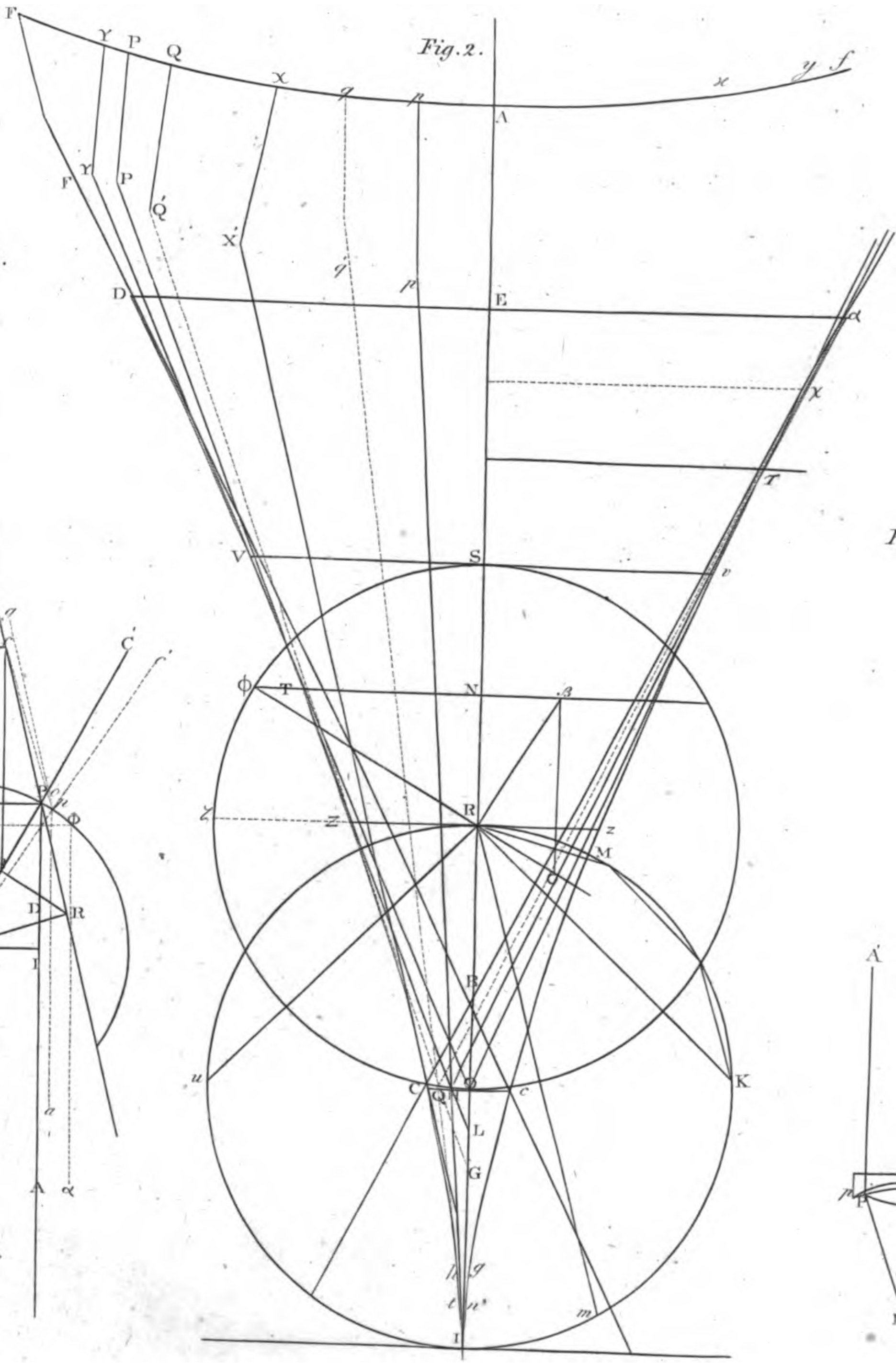

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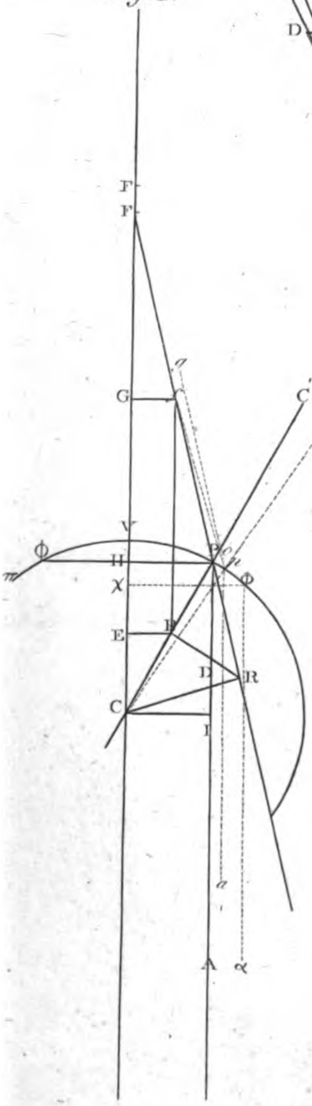

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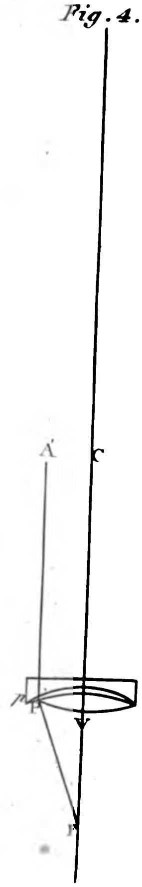

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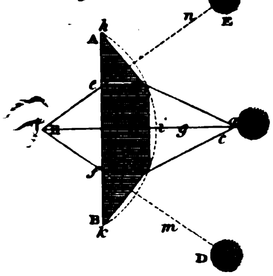

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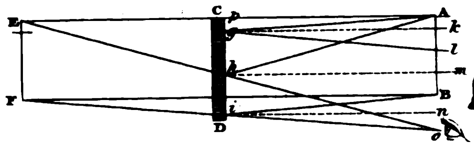

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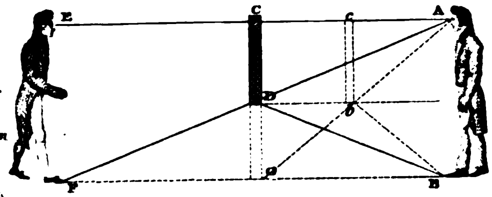

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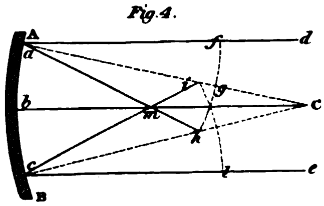

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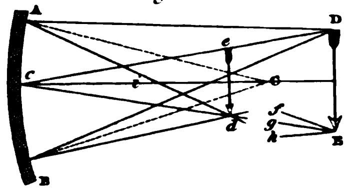

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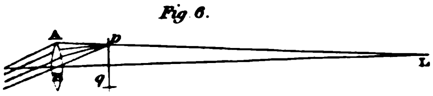

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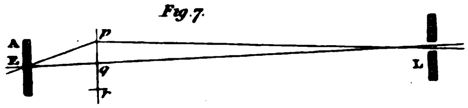

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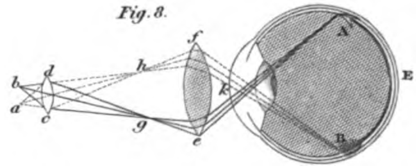

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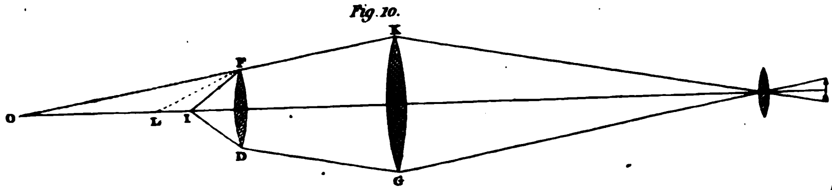

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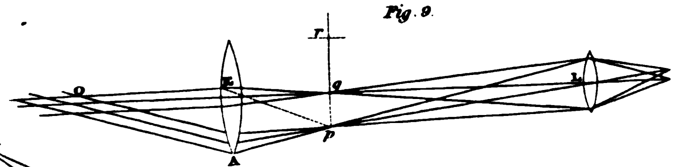
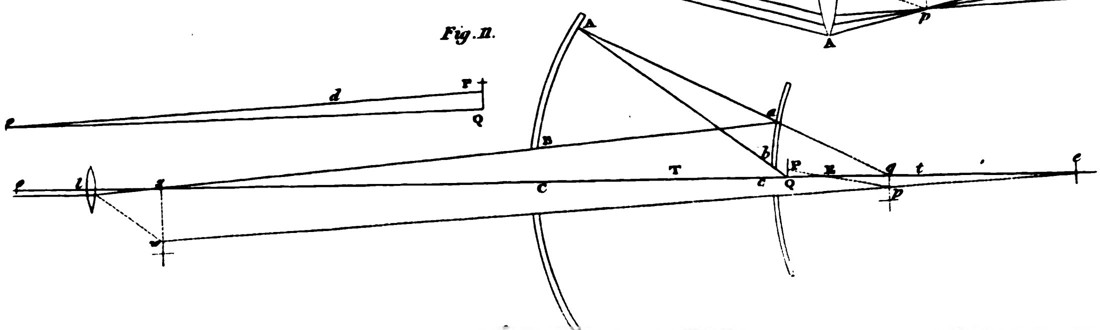


Fig. 11.



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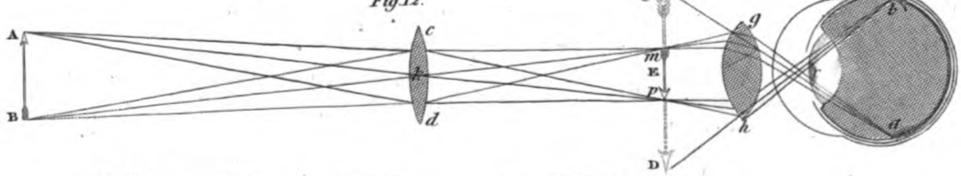

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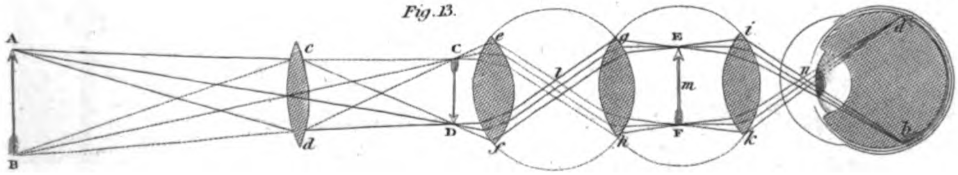

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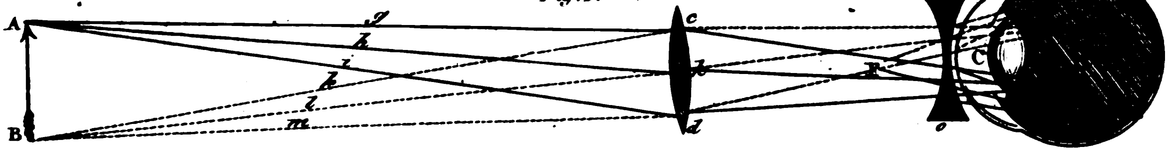

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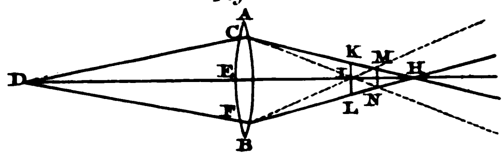

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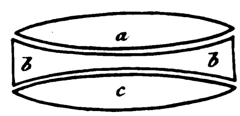

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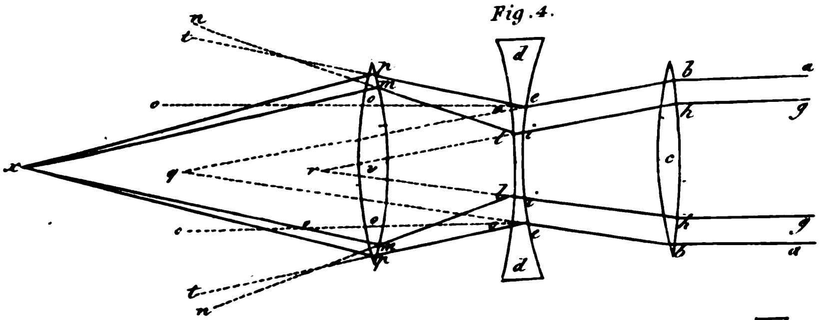

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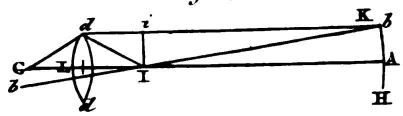

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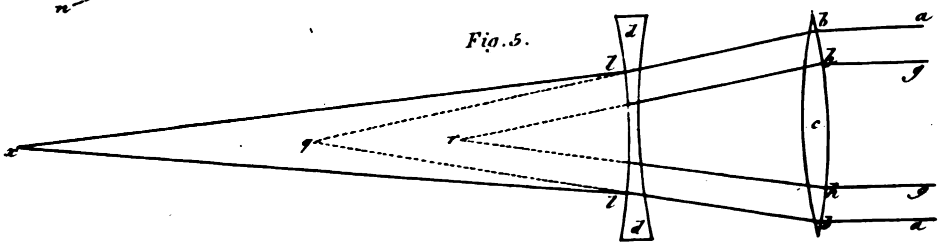

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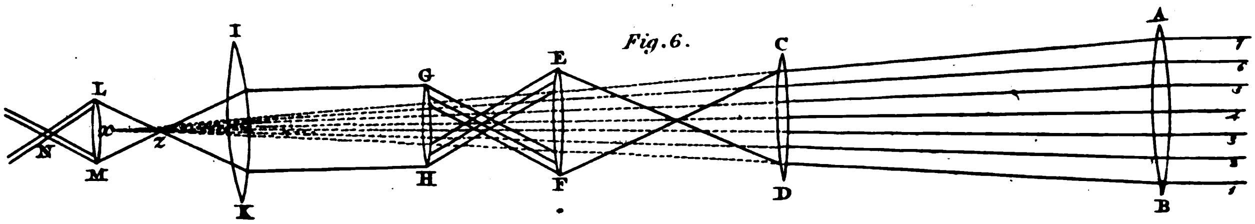

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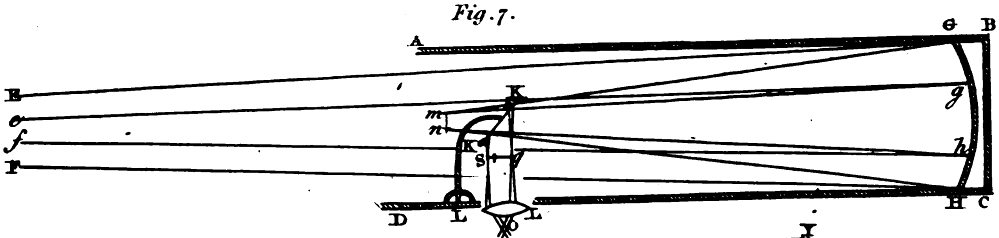

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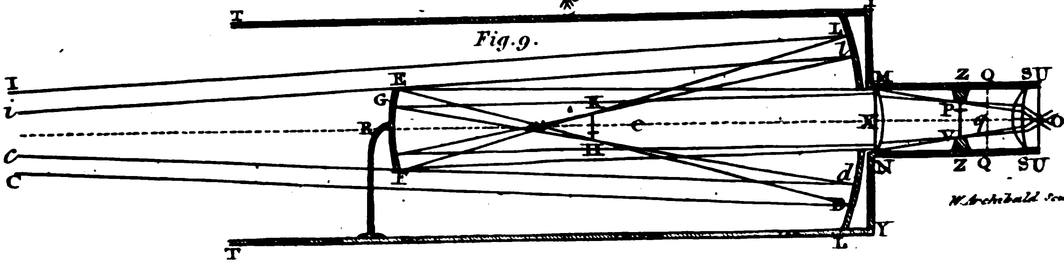

W. Archibald Sculp.

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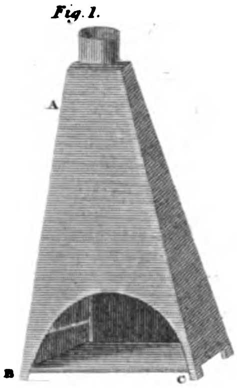

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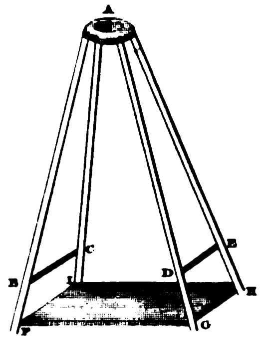

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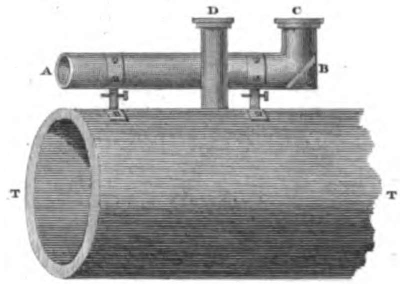

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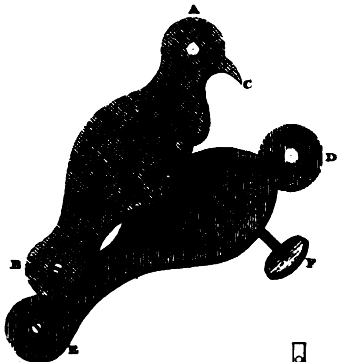

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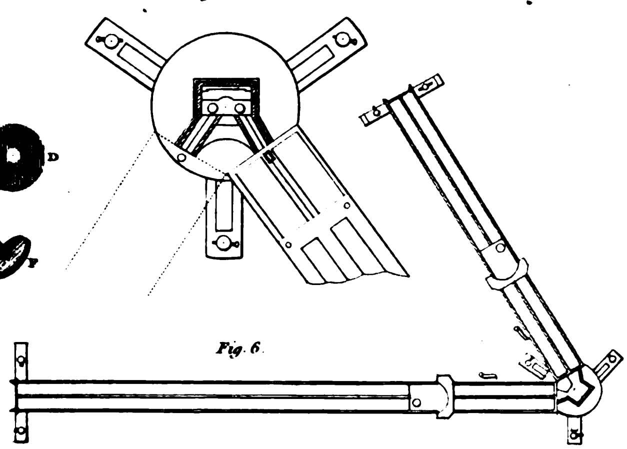

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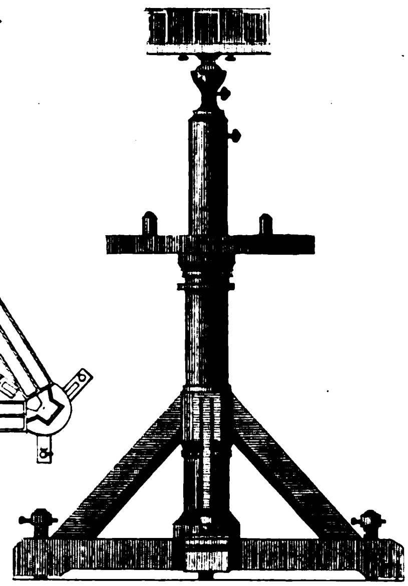

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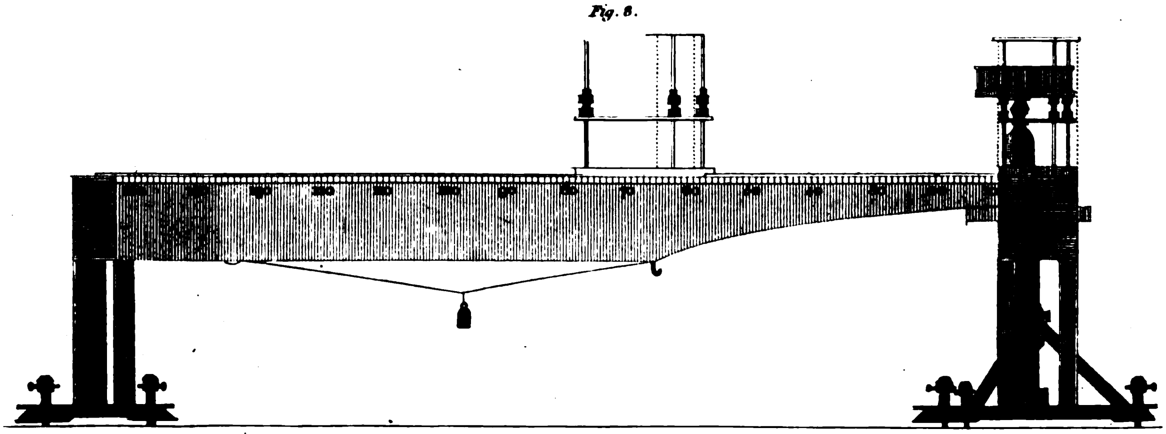

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Method of Grinding and Polishing Lenses.

five minutes, be wrought upon the concave one for a few seconds, in order to preserve the same curvature to the tools and the glass. When one side is finished off with the pumice-stone, the lens must be separated from its handle by inserting the point of a knife between it and the pitch, and giving it a gentle stroke. The pitch which remains upon the glass may be removed by rubbing it with a little oil, or spirits of wine; and after the ground side of the glass is fixed upon the handle, the other surface is to be wrought and finished in the very same manner.

281
Mode of polishing.

When the glass is thus brought into its proper form, the next and the most difficult part of the operation is to give it a fine polish. The best, though not the simplest way of doing this, is to cover the concave tool with a layer of pitch, hardened by the addition of a little rosin, to the thickness of one-fifteenth of an inch. Then having taken a piece of thin writing paper, press it upon the surface of the pitch with the convex tool, and pull the paper quickly from the pitch before it has adhered to it; and if the surface of the pitch is marked everywhere with the lines of the paper, it will be truly spherical, having coincided exactly with the surface of the convex tool. If any paper remains on the surface of the pitch, it may be removed by soap and water; and if the marks of the paper should not appear on every part of it, the operation must be repeated till the polisher, or bed of pitch, is accurately spherical. The glass is then to be wrought on the polisher by circular and cross strokes, with the oxide of tin, called the flowers of putty in the shops, or with the red oxide of iron, otherwise called colcothar of vtriol, till it has received on both sides a complete polish (C). The polishing will advance slowly at first, but will proceed rapidly when the polisher becomes warm with the friction. When it is nearly finished, no more putty or water should be put upon the polisher, which should be kept warm by breathing upon it; and if the glass moves with difficulty from its adhesion to the tool, it should be quickly removed, lest it spoil the surface of the pitch. When any particles of dust or pitch insinuate themselves between the glass and the polisher, which may be easily known from the very unpleasant manner of working, they should be carefully removed, by washing both the polisher and the glass, otherwise the lens will be scratched, and the bed of pitch materially injured.

282
By means of pitch.

283
By means of cloth.

The operation of polishing may also be performed by covering the layer of pitch with a piece of cloth, and giving it a spherical form by pressing it with the convex tool when the pitch is warm. The glass is wrought as formerly, upon the surface of the cloth, with putty or colcothar of vitriol, til a sufficient polish is induced. By this mode the operation is slower, and the polish less perfect; though it is best fitted for those who have but little experience, and would therefore be apt to injure the figure of the lens by polishing it on a bed of pitch.

In this manner the small lenses of simple and compound microscopes, the eye-glasses and the object-glasses of telescopes, are to be ground. In grinding concave lenses, Mr Imison* employs leaden wheels with the same radius as the curvature of the lens, and with their circumferences of the same convexity as the lens is to be concave. These spherical zones are fixed upon a turning lathe, and the lens, which is held steadily in the hand, is ground upon them with emery, while they are revolving on the spindle of the lathe. In the same way convex lenses may be ground and polished, by fixing the concave tool upon the lathe; but these methods, however simple and expeditious they may be, should never be adopted for forming the lenses of optical instruments, where an accurate spherical figure is indispensable. It is by the hand alone that we can perform with accuracy those circular and transverse strokes, the proper union of which is essential to the production of a spherical surface. Appendix to Ferguson's Lectures, vol. ii. p. 452.

* *School of Arts*, part ii. p. 145.

284
Impropriety of grinding, &c. on a lathe.

Sect. II. *On the Method of Casting, Grinding, and Polishing the Specula of Reflecting Telescopes.*

285
Composition of the metal.

The metals of reflecting telescopes are generally composed of 32 parts of copper, and 15 of grain tin, with the addition of two parts of arsenic, to render the composition more white and compact. The Reverend Mr Edwards found, from a variety of experiments, that if one part of brass, and one of silver, be added to the preceding composition, and only one part of arsenic used, a most excellent metal will be obtained, which is the whitest, hardest, and most reflective, that he ever met with. The superiority of this composition, indeed, has been completely evinced by the excellence of Mr Edwards' telescopes, which excel other reflectors in brightness and distinctness, and show objects in their natural colours. But as metals of this composition are extremely difficult to cast, as well as to grind and polish, it will be better for those who are inexperienced in the art, to employ the composition first mentioned.

286
Method of casting the metal.

After the flasks of sand (D) are prepared, and a mould made for the metal by means of a wooden or metallic pattern, so that its face may be downwards, and a few small holes left in the sand at its back, for the free egress of the included air;—melt the copper in a crucible by itself, and when it is reduced to a fluid state, fuse the tin in a separate crucible, and mix it with the melted copper, by stirring them together with a wooden spatula. The proper quantity of powdered arsenic, wrapt up in a piece of paper, is then to be added, the operator retaining his breath till its noxious fumes are completely dissipated; and when the scoria is removed from the fluid mass, it is to be poured out as quickly as possible into the flasks. As soon as the metal is become solid, remove it from the sand into some hot ashes or coals, for the purpose of annealing

(C) As colcothar of vitriol is obtained by the decomposition of martial vitriol, it sometimes retains a portion of this salt. When this portion of martial vitriol is decomposed by dissolution in water, the yellow ochre which results penetrates the glass, forms an incrustation upon its surface, and gives it a dull and yellowish tinge, which is communicated to the image which it forms.

(D) The finest sand which we have met with in this country, is to be found at Roxburgh castle, in the neighbourhood of Kelso.

Method of Grinding and Polishing Lenses.

annealing it, and let it remain among them till they are completely cold. The ingate is then to be taken from the metal by means of a file; and the surface of the speculum must be ground upon a common grindstone, till all the imperfections and asperities are taken away. When Mr Edwards' composition is employed, the copper and tin should be melted according to the preceding directions, and, when mixed together, should be poured into cold water, which will separate the mass into a number of small particles. These small pieces of metal are then to be collected and put into the crucible, along with the silver and brass, after they have been melted together in a separate crucible; the proper quantity of arsenic is to be added, and a little powdered rosin thrown into the fluid metal before it is poured into the flasks.

287 Grinding tools, &c.

When the metal is cast, and prepared by the common grindstone for receiving its proper figure, the gages and grinding tools are to be formed in the same manner as for convex lenses, with this difference only, that the radius of the gages must always be double the focal length of the speculum. In addition to the convex and concave brass tools, which should be only a little broader than the metal itself, a convex elliptical tool of lead and tin should also be formed with the same radius, so that its transverse may be to its conjugate diameter as 10 to 9, the latter being exactly equal to the diameter of the metal. On this tool the speculum is to be ground with flour emery, in the same manner as lenses, with circular and cross strokes alternately, till its surface is freed from every imperfection, and ground to a spherical figure. It is then to be wrought with great circumspection, on the convex brass tool, with emery of different degrees of fineness, the concave tool being sometimes ground upon the convex one, to keep them all of the same radius; and when every scratch and appearance of roughness is removed from its surface, it will be fit for receiving the final polish. Before the speculum is brought to the polisher, it has been the practice to smooth it on a bed of hones, or a convex tool made of common blue hones. This additional tool, indeed, is absolutely necessary, when silver and brass enter into the composition of the metal, in order to remove that roughness which will always remain after the finest emery has been used; but when these metals are not ingredients in the speculum, there is no occasion for the bed of hones. Without the intervention of this tool I have finished several specula, and given them as exquisite a lustre as they could possibly have received. Mr Edwards does not use any brass tools in his process, but transfers the metal from the elliptical leaden tool to the bed of hones. By this means the operation is simplified, but we doubt much if it is, in the least degree, improved. As a bed of hones is more apt to change its form than a tool of brass, it is certainly of great consequence that the speculum should have as true a figure as possible before it is brought to the hones; and we are persuaded, from experience, that this figure may be better communicated on a brass tool, which can always be kept at the same curvature by its corresponding tool, than on an elliptical block of lead. We are certain, however, that when the speculum is required to be of a determinate focal length, this length will be obtained more precisely with the brass tools than without them. But Mr Edwards has observed, that these tools are not only unnecessary, but 'really detrimental.' That Mr Edwards found them unnecessary, we cannot doubt, from the excellence of the specula which he formed without their assistance; but it seems inconceivable how the brass tools can be in the least degree detrimental. If the mirror is ground upon 20 different tools before it is brought to the bed of hones, it will receive from the last of these tools a certain figure, which it would have received even if it had not been ground on any of the rest; and it cannot be questioned, that a metal wrought upon a pair of brass tools, is equally, if not more, fit for the bed of hones, than if it had been ground merely on a tool of lead.

288 Method of polishing the metal.

When the metal is ready for polishing, the elliptical leaden tool is to be covered with black pitch, about one-twentieth of an inch thick, and the polisher formed in the same way as in the case of lenses, either with the concave brass tool, or with the metal itself. The colcothar of vitriol should then be triturated between two surfaces of glass, and a considerable quantity of it applied at first to the surface of the polisher. The speculum is then to be wrought in the usual way upon the polishing tool till it has received a brilliant lustre, taking care to use no more of the colcothar, if it can be avoided, and only a small quantity of it, if it should be found necessary. When the metal moves stifly on the polisher, and the colcothar assumes a dark muddy hue, the polish advances with great rapidity. The tool will then grow warm, and would probably stick to the speculum, if its motion were discontinued for a moment. At this stage of the process, therefore, we must proceed with great caution, breathing continually on the polisher till the friction is so great as to retard the motion of the speculum. When this happens, the metal is to be slipped off the tool at one side, cleaned with soft leather, and placed in a tube for the purpose of trying its performance; and if the polishing has been conducted with care, it will be found to have a true *parabolic* figure. Appendix to Ferguson's Lectures vol. ii. p. 457.

See the articles Achromatic Glasses, Chromatics, and Optics, in the Supplement.

INDEX.

S.

Optimates, Optio.

OPTIMATES, one of the divisions of the Roman people, opposed to *populares*. It is not easy to ascertain the characteristic differences betwixt these two parties. Some say the optimates were warm supporters of the dignity of the chief magistrate, and promoters of the grandeur of the state, who cared not if the inferior members suffered, provided the commanding powers were advanced: Whereas the populares boldly stood up for the rights of the people, pleaded for larger privileges, and laboured to bring matters nearer to a level. In short, they resembled, according to this account, the court and country parties amongst the people of this island.

Tully says, that the optimates were the best citizens, who wished to deserve the approbation of the better sort; and that the populares courted the favour of the populace, not so much considering what was right, as what would please the people and gratify their own thirst of vain glory and empty applause.

OPTIO, an officer in the Roman army, being an assistant or lieutenant to every centurion. The *optio* was so called because he was the choice or option of the centurion in later times; at first, however, he had been chosen by the tribune, or chief commander of the legion. These *optiones* are also sometimes called *succenturiones* and *tergiductores*; the last name was given them because their post was in the rear of the company. Some authors make mention of *sub-optiones* or sub-lieutenants.

Optio, Option.

It is proper, however, to add, that optiones were not peculiar to the camp, but were also used in a variety of other offices of life.

OPTION, the power or faculty of wishing, or choosing; or the choice a person makes of any thing.

When a new suffragan bishop is consecrated, the archbishop of the province, by a customary prerogative, claims the collation of the first vacant benefice, or dignity, in that see, according as he shall choose; which choice is called the archbishop's *option*.

But in case the bishop dies, or is translated, before the

the present incumbent of the promotion chosen by the archbishop shall die or be removed, it is generally supposed that the option is void; inasmuch as the granter, singly and by himself, could not convey any right or title beyond the term of his continuance in that see. And if the archbishop dies before the avoidance shall happen, the right of filling up the vacancy shall go to his executors or administrators.

OPUNTIA, a species of cactus. See CACTUS, BOTANY *Index*.

OR, the French word for gold, by which this metal is expressed in heraldry. In engraving it is denoted by small points all over the field or bearing. It may be supposed to signify of itself, *generosity*, *splendour*, or *solidity;* according to G. Leigh, if it is compounded with

Gul.	it signifies	Courage.
Azu.		Trust.
Ver.		Joy.
Pur.		Charity.
Sab.		Constancy.

ORA, in antiquity, was a term equivalent to an ounce: but it has been much debated among our antiquaries, whether the ora, the mention of which so often occurs, was a coin or only money of account. Dr Hickes observes, that the mode of reckoning money by marks and oras was never known in England till after the Danish settlements; and by examining the old nummulary estimates among the principal Gothic states upon the Baltic, it appears, that the ora and solidus were synonymous terms, and that the ora was the eighth part of the mark. From several of the Danish laws, it likewise appears, that the Danish ora, derived by corruption from *aureus*, was the same as the Frank solidus of twelve pence. As a weight, the ora was regarded as the uncia or unit, by which the Danish mark was divided; and in Doomsday book the ora is used for the ounce, or the twelfth part of the nummulary Saxon pound, and the fifteenth of the commercial; as a coin it was an aureus, or the Frank solidus of twelve pence. And from the accidental coincidence of the Frank aureus with the eighth part of their mark, the Danes probably took occasion to give it the new name of *ora*. There was another ora mentioned in the rolls of the 27th of Henry III. the value of which was sixteen pence; and this was probably derived from the half mancus of the Saxons. Such, in all appearance, was the original of these two oras; as there were no aurei of that period, to which these two denominations of money of sixteen and twelve pence can possibly be ascribed. It is observed farther, that the name *ora* distinguishes the gold coins in several parts of Europe to this day. The Portuguese moidore is nothing else but *moeda d'oro*, from the Latin *moneta de auro;* the French *Louis d'ors* come from the same use of the word, and owe their appellation to the ora. See Clarke on Coins.

ORACH. See ATRIPLEX, } BOTANY *Index*.
Wild ORACH. See CHENOPODIUM, }

ORACLE, among the heathens, was the answer which the gods were supposed to give to those who consulted them upon any affair of importance. It is also used for the god who was thought to give the answer, and for the place where it was given.

The credit of oracles was so great that in all doubts and disputes their determinations were held sacred and inviolable: whence vast numbers flocked to them for advice about the management of their affairs; and no business of any consequence was undertaken, scarce any peace concluded, any war waged, or any new form of government instituted, without the advice and approbation of some oracle. The answers were usually given by the intervention of the priest or priestess of the god who was consulted; and generally expressed in such dark and unintelligible phrases, as might be easily wrested to prove the truth of the oracle whatever was the event. It is not, therefore, to be wondered at, that the priests who delivered them were in the highest credit and esteem, and that they managed this reputation so as greatly to promote their own particular advantage. They accordingly allowed no man to consult the gods, before he had offered costly sacrifices, and made rich presents to them. And to keep up the veneration for their oracles, and to prevent their being taken unprepared, they admitted persons to consult the gods only at certain stated times; and sometimes they were so cautious, that the greatest personages could obtain no answer at all. Thus Alexander himself was peremptorily denied by the Pythia, or priestess of Apollo, till she was by downright force obliged to ascend the tripos; when, being unable to resist any longer, she cried out, *Thou art invincible:* and these words were accepted instead of a farther oracle.

Of the ambiguity of oracles, the following, out of a great many examples, may be mentioned. Crœsus having received from the Pythoness this answer, That by passing the river Halys, he would destroy a great empire; he understood it to be the empire of his enemy, whereas he destroyed his own.—The oracle consulted by Pyrrhus gave him an answer, which might be equally understood of the victory of Pyrrhus, and the victory of the Romans his enemies:

Aio te, Æacida, Romanos vincere posse.

The equivocation lies in the construction of the Latin tongue, which cannot be rendered in English.—The Pythoness advised Crœsus to guard against the mule. The king of Lydia understood nothing of the oracle, which denoted Cyrus descended from two different nations; from the Medes, by Mandana his mother, the daughter of Astyages; and from the Persians, by his father Cambyses, whose race was by far less grand and illustrious.—Nero had for answer, from the oracle of Delphos, that seventy-three might prove fatal to him. He believed he was safe from all danger till that age; but, finding himself deserted by every one, and hearing Galba proclaimed emperor, who was 73 years of age, he was sensible of the deceit of the oracle.

When men began to be better instructed by the lights philosophy had introduced into the world, the false oracles insensibly lost their credit. Chrysippus filled an entire volume with false or doubtful oracles. Oenomaus, to be revenged of some oracle that had deceived him, made a compilation of oracles, to show their ridiculous vanity. Eusebius has preserved some fragments of this criticism on oracles by Oenomaus. "I might (says Origen) have recourse to the authority of Aristotle and the Peripatetics, to make the Pythoness much suspected: I might extract from the writings

writings of Epicurus and his sectators an abundance of things to discredit oracles; and I might show that the Greeks themselves made no great account of them."

The reputation of oracles was greatly lessened when they became an artifice of politics. Themistocles, with a design of engaging the Athenians to quit Athens, and to embark, in order to be in a better condition to resist Xerxes, made the Pythoness deliver an oracle, commanding them to take refuge in wooden walls. Demosthenes said, that the Pythoness *Philippized;* to signify that she was gained over by Philip's presents.

The cessation of oracles is attested by several profane authors; as Strabo, Juvenal, Lucan, and others. Plutarch accounts for it, by saying, that the benefits of the gods are not eternal as themselves are; or that the genii, who presided over oracles, are subject to death; or that the exhalations of the earth had been exhausted. It appears that the last reason had been alleged in the time of Cicero, who ridicules it in his second book of Divination, as if the spirit of prophecy, supposed to be excited by subterraneous effluvia, had evaporated by length of time, as wine or pickle by being long kept.

Suidas, Nicephorus, and Cedrenus, relate, that Augustus, having consulted the oracle of Delphos, could obtain no other answer but this: "The Hebrew child, whom all the gods obey, drives me hence, and sends me back to hell: get out of this temple without speaking one word." Suidas adds, that Augustus dedicated an altar in the Capitol, with this inscription, "To the eldest son of God." Notwithstanding these testimonies, the answer of the oracle of Delphos to Augustus seems very suspicious. Cedrenus cites Eusebius for this oracle, which is not now found in his works; and Augustus's peregrination into Greece was 18 years before the birth of Christ.

Suidas and Cedrenus give an account also of an ancient oracle delivered to Thulis, a king of Egypt, which they say is well authenticated. The king having consulted the oracle of Serapis, to know if there ever was, or would be, one so great as himself, received this answer: First God, next the Word, and the Spirit with them. They are equally eternal, and make but one whose power will never end. But thou, mortal, go hence, and think that the end of the life of man is uncertain."

Van Dale, in his treatise of oracles, does not believe that they ceased at the coming of Christ. He relates several examples of oracles consulted till the death of Theodosius the Great. He quotes the laws of the emperors Theodosius, Gratian, and Valentinian, against those who consulted oracles, as a certain proof that the superstition of oracles still subsisted in the time of those emperors.

According to others, the opinion of those who believe that demons had no share in the oracles, and that the coming of the Messiah made no change in them, and the contrary opinion of those who pretend that the incarnation of the Word imposed a general silence on all oracles, should be equally rejected. They allege, that two sorts of oracles ought to be distinguished: the one dictated by the spirits of darkness, who deceived men by their obscure and doubtful answers; the other, the pure artifice and cheat of the priests of false divinities. As to the oracles given out by demons, the reign of Satan was destroyed by the coming of the Saviour; truth shut the mouth of lies; but Satan continued his old craft among idolaters. All the devils were not forced to silence at the same time by the coming of the Messiah; it was on particular occasions that the truth of Christianity, and the virtue of Christians, imposed silence on the devils. St Athanasius tells the Pagans, that they have been witnesses themselves that the sign of the cross puts the devils to flight, silences oracles, and dissipates enchantments. This power of silencing oracles, and putting the devils to flight, is also attested by Arnobius, Lactantius, Prudentius, Minutius Felix and several others. Their testimony is a certain proof that the coming of the Messiah had not imposed a general silence on oracles.

Plutarch relates, that the pilot Thamus heard a voice in the air, crying out, "The great Pan is dead;" whereupon Eusebius observes, that the accounts of the death of the demons were frequent in the reign of Tiberius, when Christ drove out the wicked spirits.

The same judgment, it is said, may be passed on oracles as on *possessions*. It was on particular occasions, by the divine permission, that the Christians cast out devils, or silenced oracles, in the presence, and even by the confession, of the Pagans themselves. And thus it is we should, it seems, understand the passages of St Jerome, Eusebius, Cyril, Theodoret, Prudentius, and other authors, who said that the coming of Christ had imposed silence on the oracles.

As to the second sort of oracles, which were pure artifices and cheats of the priests of false divinities, and which probably exceeded the number of those that immediately proceeded from demons, they did not cease till idolatry was abolished, though they had lost their credit for a considerable time before the coming of Christ. It was concerning this more common and general sort of oracles that Minutius Felix said, they they began to discontinue their responses, according as men began to be more polite. But, however oracles were decried, impostors always found dupes, the grossest cheats having never failed.

Daniel discovered the imposture of the priests of Bel, who had a private way of getting into the temple to take away the offered meats, and who made the king believe that the idol consumed them.—Mundus, being in love with Paulina, the eldest of the priestesses of Isis, went and told her, that the god Anubis, being passionately fond of her, commanded her to give him a meeting. She was afterwards shut up in a dark room, where her lover Mundus, whom she believed to be the god Anubis, was concealed. This imposture having been discovered, Tiberius ordered those detestable priests and priestesses to be crucified, and with them Idæa, Mundus's free woman, who had conducted the whole intrigue. He also commanded the temple of Isis to be levelled with the ground, and her statue to be thrown into the Tiber; and, as to Mundus, he contented himself with sending him into banishment.

Theophilus, bishop of Alexandria, not only destroyed the temples of the false gods, but discovered the cheats of the priests, by showing that the statues, some of which were of brass, and others of wood, were hollow within, and led into dark passages made in the wall.

Lucian, in discovering the impostures of the false prophet Alexander, says, that the oracles were chiefly afraid of the subtilties of the Epicureans and Christians. The false prophet Alexander sometimes feigned himself seized with a divine fury, and by means of the herb sopewort, which he chewed, frothed at the mouth in so extraordinary a manner, that the ignorant people attributed it to the strength of the god he was possessed by. He had long before prepared a head of a dragon made of linen, which opened and shut its mouth by means of a horse hair. He went by night to a place where the foundations of a temple were digging: and having found water, either of a spring, or rain that had settled there, he hid in it a goose egg, in which he had enclosed a little serpent that had been just hatched. The next day, very early in the morning he came quite naked into the street, having only a scarf about his middle, holding in his hand a scythe, and tossing about his hair as the priests of Cybele; then getting a-top of a high altar, he said that the place was happy to be honoured by the birth of a god.—Afterwards, running down to the place where he had hid the goose egg, and going into the water, he began to sing the praises of Apollo and Æsculapius, and to invite the latter to come and show himself to men. With these words, he dips a bowl into the water, and takes out the mysterious egg, which had a god enclosed in it; and when he had it in his hand, he began to say that he held Æsculapius. Whilst all were eager to have a sight of this fine mystery, he broke the egg, and the little serpent starting out, twisted itself about his fingers.

These examples show clearly, that both Christians and Pagans were so far agreed as to treat the *greater number* of oracles as purely human impostors. That, in fact ALL of them were so, will be concluded by those who give equal credit to demoniacal *inspiration*, and demoniacal *possession*. The most ancient oracle was that of Dodona (see DODONA); but the most famous was that of Delphi, to which article we also refer for farther particulars on this subject, so famous in Pagan antiquity. Another celebrated one was the oracle of Trophonius, in the neighbourhood of Lebadia, a city of Bœotia, which was held in high estimation. It received its name from Trophonius, brother of Agamedes, who lived in a subterraneous dwelling near Lebadia, and pretended to the faculty of foretelling future events. He died in his cave, and was deified as an oracular god. This oracle owed its reputation to one Saon.

Those who repaired to this cave for information, were required to offer certain sacrifices, to anoint themselves with oil, and to bathe in a certain river: They were then clothed in a linen robe, took a honeyed cake in their hands, and descended into the subterraneous chamber by a narrow passage. Here it was that futurity was unfolded to them, either by visions or extraordinary sounds. The return from the cave was by the same passage, but the persons consulting were obliged to walk backwards. They generally came out astonished, melancholy, and dejected; hence the proverb εις Τροφωνιου μεμαντευται. The priests on their return placed them on an elevated seat, called *the seat of Mnemosyne*, where an account was taken of what they had seen and heard. They were then conducted to the chapel of good Genius by their companions, where, by degrees, they recovered their usual composure and cheerfulness.

Besides these three principal oracles of Greece, it is proper to take notice of that of Amphiaraus at Oropius in Attica. It was so called from Amphiaraus, the son of Oicleus, a man skilled in magic, the interpretation of dreams, &c. and who after his death was deified and delivered oracles in a temple erected to his divinity. (See AMPHIARAUS). They who applied to them for information, were to purify themselves, offer sacrifice, fast twenty-four hours, abstain from wine two days, and make an offering of a ram to Amphiaraus; on the skin of which they were to sleep, and see their destiny in a dream. Near the temple was Amphiaraus's fountain, which was sacred, and the waters of it forbidden to be used for ordinary purposes.

At Delos also there was an oracle of the Delian Apollo; in Milesia was that of the Branchidæ, with others of less note, which require not a particular description, such as that of the camps at Lacedæmon, that of Nabarcha, that of Chrysopolis, that of Claros in Ionia, that of Mallos, that of Patarea, that of Pella, that of Phasellides, that of Sinope, that of Orpheus's head, &c.

Though the Romans consulted the Grecian oracles upon many occasions, and had few oracles in their own country; yet we must not omit mentioning the Cumæan oracles which were delivered by the Sibyl of Cumæ. For an account of the Sibyls, see the article SIBYL. See also DÆMON and DÆMONIAC.

We have hitherto only considered the oracles of false gods, of which there was a far greater number than our limits permit us to observe, and before either Greeks or Romans had risen to any distinction. Oracle is in sacred history sometimes used for the mercy seat, or the cover of the ark of the covenant; and by others it is taken for the sanctuary, or for the most holy place, wherein the ark was deposited.

Among the Jews we may distinguish several sorts of *real* oracles. They had first oracles that were delivered *viva voce;* as when God spake to Moses face to face, as one friend speaks to another, (Numb. xii. 8.). Secondly, Prophetical dreams sent by God; as the dreams which God sent to Joseph, and which foretold his future greatness, (Gen. xxxvii. 5, 6.). Thirdly, Visions; as when a prophet in an ecstasy, being neither properly asleep nor awake, had supernatural revelations, (Gen. xv. 1. xlvi. 2.). Fourthly, The oracle of Urim and Thummim, which was accompanied with the ephod or the pectoral worn by the high priest, and which God had endued with the gift of foretelling things to come, (Numb. xii. 6. Joel ii. 28.). This manner of inquiring of the Lord was often made use of, from Joshua's time to the erection of the temple at Jerusalem. Fifthly, After the building of the temple, they generally consulted the prophets, who were frequent in the kingdoms of Judah and Israel. From Haggai, Zechariah, and Malachi, who are the last of the prophets that have any of their writings remaining, the Jews pretend that God gave them what they call *Bathcol*, the daughter of the voice, which was a supernatural manifestation of the will of God, which was performed either by a strong inspiration or internal voice, or else by a sensible and

and external voice, which was heard by a number of persons sufficient to bear testimony of it. For example, such was the voice that was heard at the baptism of Jesus Christ, saying, This is my beloved Son, &c. (Matth. iii. 17.).

The Scripture affords us examples likewise of profane oracles. Balaam, at the instigation of his own spirit, and urged on by his avarice, fearing to lose the recompense that he was promised by Balak king of the Moabites, suggests a diabolical expedient to this prince, of making the Israelites fall into idolatory and fornication (Numb. xxiv. 14. xxxi. 16.), by which he assures him of a certain victory, or at least of considerable advantage against the people of God.

Micaiah the son of Imlah, a prophet of the Lord, says (1 Kings xxii. 21, &c.), that he saw the Almighty sitting upon his throne, and all the host of heaven round about him; and the Lord said, who shall tempt Ahab king of Israel, that he may go to war with Ramoth-gilead, and fall in the battle? One answered after one manner, and another in another. At the same time an evil spirit presented himself before the Lord, and said, I will seduce him. And the Lord asked him, How? To which Satan answered I will go and be a lying spirit in the mouth of his prophets. And the Lord said, Go and thou shalt prevail. This dialogue clearly proves these two things: *first*, that the devil could do nothing by his own power; and, *secondly*, that with the permission of God, he could inspire the false prophets, sorcerers, and magicians, and make them deliver false oracles.

Respecting the cessation of profane oracles there have been a variety of opinions; some of which we have already remarked. It has been generally held, indeed, that oracles ceased at the birth of Jesus Christ: Yet some have endeavoured to maintain the contrary, by showing that they were in being in the days of Julian, commonly called the *Apostate*, and that this emperor himself consulted them; nay, farther, say they, history makes mention of several laws published by the Christian emperors Theodosius, Gratian, and Valentinian, to punish persons who interrogated them, even in their days; and that the Epicureans were the first who made a jest of this superstition, and exposed the roguery of its priests to the people. As we suspect most of the facts here asserted should be understood in a qualified sense, we shall endeavour to discuss this point of controversy in as few words as possible, although it is undoubtedly a matter of some consequence.

1st, The question, properly stated, is not, Whether oracles became extinct *immediately upon the birth of Christ*, or from the very moment he was born; but, If they fell gradually into disesteem and ceased, as Christ and his gospel became known to mankind. And that they did so, is most certain from the concurrent testimonies of the fathers, which, whoever would endeavour to invalidate, may equally give up the most respectable traditions and relations of every kind.

2dly, But did not Julian the apostate consult these oracles? We answer in the negative: he had indeed recourse to magical operations, but it was because oracles had already ceased; for he bewailed the loss of them, and assigned pitiful reasons for it; which St Cyril has vigorously refuted, adding, that *he never could have offered such, but from an unwillingness to acknowledge, that when the world had received the light of Christ, the dominion of the devil was at an end.*

3dly, The Christian emperors do indeed seem to condemn the superstition and idolatry of those who were still for consulting oracles; but the edicts of those princes do not prove that oracles actually existed in their times, any more than that they ceased in consequence of their laws. It is certain that they were for the most part extinct before the conversion of Constantine.

4thly, Some Epicureans might *make a jest of this superstition*: however, the Epicurean philosopher Celsus, in the second century of the church, was for crying up the excellency of several oracles, as appears at large from Origen's seventh book against him.

ORÆA, certain solemn sacrifices of fruits which were offered in the four seasons of the year, in order to obtain mild and temperate weather. They were offered to the goddesses who presided over the seasons, who attended upon the sun, and who received divine worship at Athens.

ORAL, something delivered by word of mouth, without being committed to writing; in which sense we say oral law, oral tradition, &c.

ORAN, a very strong town of Africa, in Barbary, with several forts, and an excellent harbour. It is seated partly on the side of a hill, and partly on a plain, about a stonecast from the sea, almost opposite to Carthagena in Spain, and is about a mile and a half in circumference. In 1790, 2000 of the inhabitants perished by an earthquake which nearly destroyed the whole town. It was taken by the Spaniards in 1509, and retaken by the Algerines in 1708; but in 1732 the Spaniards became masters of it, and have continued so ever since. E. Long. 0. 8. N. Lat. 36. 2.

ORANG OUTANG. See SIMIA, MAMMALIA *Index*.

ORANGE, a city, and capital of a province of the same name, united to Dauphiny, with a university and a bishop's see, suffragan of Arles. It is seated in a fine large plain, watered by a vast number of little rivulets on the east side of the river Rhone, and in the department of Vaucluse. It is a very large ancient place, and was considerable in the time of the Romans, who adorned it with several buildings, of which there are still some ruins left, particularly of an amphitheatre, and a triumphal arch which is almost entire, dedicated to Marius. The town contained 7270 inhabitants in 1800. The wall was in 1682 entirely demolished by order of Louis XIV. and the inhabitants were exposed to the fury of the soldiers. The town was restored to King William by the treaty of Ryswick; but after his death the French took it again, and expelled the Protestant inhabitants. By the treaty of Utrecht it was confirmed to the crown of France, though the title is still retained in the house of Nassau. The title was first introduced into the family of Nassau, by the marriage of Claude de Chalons, the prince of Orange's sister, with the count of Nassau, 1530. The principality is a very small district, it being only twelve miles in length and nine in breadth, and the revenue amounts to about 5000l. a-year. The country is pleasant, and abounds with corn and fruit, but is exposed to violent winds. E. Long. 4. 49. N. Lat. 44. 9.

Maurice Prince of ORANGE. See MAURICE.

ORANGE *River*, also known by the name of the Great

Great river, is situated in southern Africa, and is of considerable extent. It seems to take its rise about S. Lat. 30°, and E. Long. 28° from Greenwich, and joins the sea, after a west by north course for a number of leagues, between the great and little Namaquas, two tribes supposed to be of the same origin with the Hottentots. There are high cataracts in it, and it is subjet to inundations like the Nile. Carnelians, calcedonies, agates, and variolites are found upon the shores. The rains in the great mountains along the foot of which the Orange river runs, collecting their streams in its passage, commence in the month of November, and cause the inundations to take place towards the Namaqua country in the month of December. The nauseous custom of greasing the skin, from the great scarcity of water in many parts of South Africa, is rendered unnecessary among the people who inhabit the banks of this grand river; and of consequence they exhibit none of that filthy appearance which is characteristic of the Hottentots on the skirts of the colony.

Orange-Tree, in *Botany*. See Citrus, Botany *Index*.—Orange flowers are justly esteemed one of the finest perfumes; and though little used in medicine, yet the water distilled from them is accounted stomachic, cordial, and carminative. The fruit is cooling, and good in feverish disorders, and particularly in diarrhœas. Orange-peel is an agreeable aromatic, proper to repair and strengthen the stomach, and gives a very grateful flavour to any infusions or tinctures into whose compositions it enters. It is particularly useful in preparations of the bark: gives an agreeable warmth to the infusion; and, according to Dr Percival, considerably increases its virtue.

In the Philosophical Transactions, N° 114. there is a very remarkable account of a tree standing in a grove near Florence, having an *orange* stock, which had been so grafted upon, that it became in its branches, leaves, flowers and fruit, three-formed: some emulating the orange, some the lemon or citron, and some partaking of both forms in one; and what was very remarkable was, that these mixed fruits never produced any perfect seeds: sometimes there were no seeds at all in them, and sometimes only a few empty ones.

Orange-Dew, a kind of dew which falls in the spring time from the leaves of orange and lemon trees, which is extremely fine and subtile. M. de la Hire observing this, placed some flat pieces of glass under the leaves to receive it: and having procured some large drops of it, was desirous of discovering what it was. He soon found that it was not merely an aqueous fluid, because it did not evaporate in the air; and that it was not a resin, because it readily and perfectly mixed with water: it was natural then to suppose it a liquid gum; but neither did this, on examination, prove to be the case; for being laid on paper, it did not dry as the other liquid gums do. Its answering to none of these characters, and its being of the consistence of honey, and of a sweet sugar-like taste, gave a suspicion of its being a kind of manna; and whatever in the other trials had proved it not a resin, a gum, &c. all equally tends to prove that it is this substance.

Orange, Sea, in *Natural History*, a name given by Count Marsigli to a very remarkable species of marine substance, which he denominates a *plant*. It is tough and firm in its structure, and in many things resembles the common fucus; but instead of growing in the branched form which the generality of those substances have, it is round and hollow, and in every respect resembles the shape of an orange. It has, by way of root, some exceeding fine filaments, which fasten themselves to the rocks, or to shells, stones, or any thing else that comes in the way. From these there grows no pedicle; but the body of the orange, as it is called, is fastened by them to the rock, or other solid substance. The orange itself is usually of about three or four inches in diameter; and while in the sea, is full of water, and even retains it when taken up. In this state it frequently weighs a pound and a half; but when the water is let out, and it is dried, it becomes a mere membrane, weighing scarce any thing. It is best preserved, by stuffing it with cotton as soon as the water is let out of it, and then hanging it up to dry. Its surface is irregular and rough, and its colour a dusky green on the outside, and a clearer but somewhat bluish green within; and its thickness is about an eighth part of an inch. When viewed by the microscope, it is seen to be all over covered with small glandules, or rather composed of them; for they stand so thick one by another as to leave no space between, and seem to make up the whole substance; so that it appears very like the rough shagreen skin used to cover toys. These are indeed so many hollow ducts, through which the sea-water finds a passage into the globe formed by this skin, and by this means it is kept always full and distended; on cutting it with a pair of scissars, the water immediately runs out, and the skins collapse; but there is something extremely remarkable in this, for the whole substance, near the wounded place, is in motion, and seems as if alive, and sensible of the wound. The glandules are found full of water, and resembling small transparent bottles; and what goes to the structure of the plant beside these, is an assemblage of a vast number of filaments, all which are likewise hollow, and filled with a clear and transparent fluid.

There is another substance of this kind, mentioned and described by Count Marsigli, Triumfetti, and others, and called the *ramose* or branched orange. This is very much of the nature of the former; but instead of consisting of one round globule, it is formed of several oblong ones all joined together, and representing the branches of some of the fucuses, only they are shorter; and these are all hollow and full of water, in the same manner as the single globes of the common kind. This has, by way of root, certain fine and slender filaments, which fasten it to the stones or shells near which it is produced; and it is of a dusky greenish colour on the surface, and of a fine bluish green within. The surface view'd by the microscope, appears rough, as in the other, and the glandules are of the same kind, and are always found full of clear water.

ORATION, in *Rhetoric*, a speech or harangue, composed according to the rules of oratory, but spoken in public. Orations may be reduced to three kinds, viz. the demonstrative, deliberative, and judicial. To the demonstrative kind belong panegyrics, genethliaca, epithalamia, congratulations, &c. To the deliberative kind belong persuasion, exhortation, &c. And to the judicial kind belong accusation, confutation, &c.

Funeral

Oration, Orator.

Funeral Oration. See *Funeral Oration*.

ORATOR, among the Romans, differed from a *patronus*: The latter was allowed only to plead causes on behalf of his clients; whereas the former might quit the forum and ascend the rostra or tribunal, to harangue the senate or the people. The orators had rarely a profound knowledge of the law, but they were eloquent, and their style was generally correct and concise. They were employed in causes of importance, instead of the common patrons. Orators in the violence of elocution used all the warmth of gesture, and even walked backwards and forwards with great heat and emotion. This it was which occasioned a witticism of Flavius Virginius, who asked one of those walking orators, *Quot millia passuum declamâsset?* "How many MILES he had declaimed?" Similar to the Roman orators were the Grecian *Rhetores*. See RHETORES.

Public Orator, an office of very considerable dignity, and of some emolument, in the English universities.

The public orator is the principal, and in many cases the only ostensible, agent for the university, in all those matters or forms which are merely external. He carries on or superintends all correspondences which are calculated to promote the dignity, or raise the utility, of the seminary which constitutes him. He has little to do, indeed, with the internal government of the body, for which a variety of officers in different departments are appointed; but in all public affairs he is, as it were, the mouth of the whole; putting their deliberations into proper form, and communicating or publishing them, according to the intention of the university. Thus, if the whole university, or a committee appointed by them, or by statute, or by the will of any particular benefactor, have, after a comparative trial, adjudged a prize to any person or persons, it is the business of the public orator to inform the successful parties of the issue of the trial. Again, If for singular learning, or for any remarkable *good will* shown to the university by any person or persons, the *senate* or *convocation* are pleased to declare their grateful sense of it either by conferring degrees, or otherwise, as they think fit, the public orator is to notify this intention to the person or persons concerned; and so in other cases.

Another part of the public orator's business is to present young noblemen, or those who take *honorary* degrees, *tanquam nobiles*, to the vice-chancellor; this he does in a Latin speech, which, according to circumstances, is either short or long; and of which the subject is generally a defence of that particular statute which allows the sons of noblemen, and some few others, to proceed to degrees before what is called the *statutable time*. In doing this, encomiums, often stronger than just, are made upon the learning and virtue of the noble candidate; a view is taken of the dignity of his ancient house; the honour is mentioned which has accrued to the university from the accession of such a member; and the oration concludes with promising great credit from his future conduct, as well as benefit from the influence of his rank in the state. These circumstances are deemed sufficient grounds for exempting the sons of noblemen from that tedious course of study, through which the duller sons of commoners must all pass before they be thought worthy of academical honours.

Orator, Oratorio.

ORATORIO, in the Italian music, a sort of sacred drama of dialogues; containing recitativos, duettos, trios, ritornellos, choruses, &c. The subjects of those pieces are usually taken from Scripture, or the life of some saint, &c. The music for the oratorios should be in the finest taste and best chosen strains. These oratorios are greatly used at Rome in the time of Lent, and of late in England.

Menestrier attributes the origin of oratorios to the crusades, and says that the pilgrims returning from Jerusalem and the Holy Land, &c. composed songs reciting the life and death of the Son of God, and the mysteries of the Christian faith, and celebrating the achievements and constancy of saints and martyrs. Others, with more probability, observe, that the oratorio was an avowed imitation of the opera, with only this difference, that the foundation of it was always some religious or at least some moral subject. Crescimbeni ascribes its origin to San Filippo Neri, who was born at Florence in 1515, and who, in his chapel after sermons, and other devotions, in order to allure young people to pious offices, had hymns, psalms, and such like prayers, sung by one or more voices. Among the spiritual songs were dialogues; and these entertainments becoming more frequent, and improving every year, were the occasion that in the seventeenth century oratorios were first invented, so called from the place of their origin. See *Hawkins's History of Music*.

ORATORY;

THE ART OF SPEAKING WELL UPON ANY SUBJECT, IN ORDER TO PERSUADE.

INTRODUCTION.

§ 1. *Of the Rise and Progress of Oratory.*

1 The origin of the art of oratory.

THE invention of oratory is, by the Egyptians, and the fables of the poets, ascribed to Mercury. And it is well known, that the Greeks made their deities the authors likewise of other arts, and supposed that they presided over them. Hence they gave Mercury the titles of Λογιος and Ερμης, both which names come from words that signify "to speak." And Aristides calls eloquence *the gift of Mercury*; and for the same reason anciently the tongue who consecrated to him. He was likewise said to be the interpreter or messenger of the gods; which office very well suited him, as he excelled in eloquence. Hence we read in the Sacred Writings, that when the people of Lystra took Barnabas and Paul for gods in human shape, because of that sudden and surprising cure which was wrought upon the lame man, they called Barnabas *Jupiter*, and Paul *Mercury*; for this reason, as the inspired writer tells us, 'because he was the chief speaker,' that is (as the spectators then thought), the interpreter or spokesman of Barnabas.

But to pass over these fictions of the heathen deities, let us hear what Quintilian says of the *origin* of this art; who seems to give a very probable account of it in the following passage. "The faculty of speech (says he) we derive from nature (A); but the art from observation. For as in physic, men, by seeing that some things promote health, and others destroy it, formed the art upon those observations; in like manner, by perceiving that some things in discourse are said to advantage, and others not, they accordingly marked those things, in order to imitate the one and avoid the other. They also added some things from their own reason and judgement, which, being confirmed by use, they began to teach others what they knew themselves." But no certain account can be given when, or by whom, this method of observation first began to take place. And Aristotle supposes, not without reason, that the first lineaments of the art were very rude and imperfect. Pausanias, indeed, in his *Description of Greece*, tells us, that Pittheus, the uncle of Theseus, taught it at Trœzene, a city of Peloponnesus, and wrote a book concerning it, which he read himself, as it was published by one of Epidaurus. But as Pittheus lived above 1000 years before Pausanias, who flourished in the time of the emperor Hadrian, some are of opinion he might be imposed upon by the Epidaurian, who published this book under the name of *Pittheus*. But be that as it will, it is very reasonable to believe, that the Greeks had the principles of this art so early as the time of Pittheus. For Theseus his nephew lived not long before the taking of Troy, which, according to Sir Isaac Newton, happened 904 years before the birth of Chirst; at which time Cicero thought it was in much esteem among them. "Homer (says he) would never have given Ulysses and Nestor in the Trojan war so great commendations on account of their speeches (to one of whom he attributes force, and to the other sweetness of expression), if eloquence had not in those times been in great repute." And lest any one should imagine, that in those days they made use only of such helps as nature and practice could afford them, the same poet informs us, that Peleus sent Phœnix with his son Achilles to the Trojan war, to instruct him not only in the art of war, but likewise of eloquence. But who were the professors of this art for some ages following is not known. For Quintilian says, that afterwards Empedocles is the first upon record who attempted any thing concerning it. And he, by Sir Isaac Newton's account, flourished about 500 years after Troy was taken. At which time, as Cicero observes, men being now sensible of the powerful charms of oratory, and the influence it had upon the mind, there immediately arose several masters of it; the chief of whom are mentioned by Quintilian, who tells us, that 'the oldest writers upon this art are Corax and Tisias, both of Sicily. After them came Gorgias of Leontium in the same island, who is said to have been the scholar of Empedocles, and by reason of his great age (for he lived to be 109 years old) had many cotemporaries. Thrasymachus of Chalcedon, Prodicus of Cea, Protagoras of Abdera, Hippias of Elis, and Alcidamus of Elea, lived in his time; as likewise Antiphon, who first wrote orations, and also upon the art, and is said to have spoken admirably well in his own defence; and besides these, Polycrates, and Theodore of Byzantium.' These persons contributed different ways towards the improvement of the art. Corax and Tisias gave rules for methodizing a discourse, and adjusting its particular parts; as may be conjectured from Cicero's account of them, who says, "Though some had spoke well before their time, yet none with order and method." But Gorgias seems to have excelled all the rest in fame and reputation: for he was so highly applauded by all Greece, that a golden statue was erected to him at Delphos, which was a distinguishing honour conferred upon him only. And he is said to have been so great a master of oratory, that in a public assembly he could undertake to declaim immediately upon any subject proposed to him. He wrote, as Cicero informs us, in the demonstrative or laudatory way; which requires most of the sublime, and makes what Diodorus Siculus says of him the more probable, that "he first introduced the strongest figures, members of periods opposite in sense, of an equal length, or ending with a like sound, and other ornaments of that nature." And hence those figures, which give the greatest force and lustre to a discourse, were anciently called by his name. Cicero tells us further, that Thrasymachus and Gorgias were the first who introduced numbers into prose, which Isocrates afterwards brought to perfection. Quintilian likewise mentions Protagoras, Gorgias, Prodicus, and Thrasymachus, as the first who treated of common places, and showed the use of them for the invention of arguments. Nor must we omit Plato, whose elegant dialogue upon this subject is still extant, which he entitles *Gorgias*. For though he does not lay down the common rules of the art; yet he very well explains the nature of it, and maintains its true end and use against the generality of its professors, who had greatly perverted the original design of it. Thus by the study and industry of so many ingenious and great men, the art of oratory was then carried to a considerable height among the Grecians: though many of those who professed it in those times employed their skill rather to promote their own reputation and applause, than to serve the real interests of truth and virtue. "For they proposed in an arrogant manner (as Cicero says) to teach how a bad cause might be so managed, as to get the better of a good one." That is, they would undertake to charm the ears and strike the passions of their hearers in so powerful a manner, by sophistical reasonings, turns of wit, and fine language, as to impose falsehood upon them for truth: than which nothing could be either more disingenuous in itself, or prejudicial to society.

2 Orators of Greece.

But those who succeeded them seem to have consulted

(A) If Quintilian meant that the human race speak an articulate language by nature or instinct, he certainly deceived himself (see LANGUAGE); but if his meaning was only that men have from nature a capability of speech, the observation is true, but not of much value. Parrots and other birds have a capability of uttering articulate sounds.

ed better, both for their own honour and that of their profession. Isocrates was the most renowned of all Gorgias's scholars, whom Cicero frequently extols with the highest commendations, as the greatest master and teacher of oratory; "whose school (as he says) like the Trojan horse, sent forth abundance of great men." Aristotle was chiefly induced to engage in this province from an emulation of his glory; and would often say in a verse of Sophocles, somewhat varied to his purpose,

> To be silent it is a shame;
> While Isocrates gets such fame.

Quintilian says they both wrote upon the art, though there is no system of the former now extant. But that of Aristotle is esteemed the best and most complete of any in the Greek language. In this age the Grecian eloquence appeared in its highest perfection. Demosthenes was a hearer both of Isocrates and Plato, as also of Isæus (ten of whose orations are yet extant); and by the assistance of a surprising genius, joined with indefatigable industry, made that advantage of their precepts, that he has been always esteemed by the best judges the prince of Grecian orators. His great adversary and rival Æschines, after his banishment, is said to have gone to Rhodes, and employed his time there in teaching of rhetoric. Theodectes and Theophrastus, both of them scholars of Aristotle, imitated their master in writing upon the art. And from that time the philosophers, especially the Stoics and Peripatetics, applied themselves to lay down the rules of oratory; which Socrates had before separated from the province of a philosopher. And there is yet preserved a treatise upon this subject, which some have ascribed to Demetrius Phalereus the Peripatetic, and scholar of Theophrastus, though others more probably to Dionysius of Halicarnassus. Quintilian mentions several other famous rhetoricians in the following ages, who were likewise writers: As Hermagoras, Athenæus, Apollonius Molon, Areus Cæcilius, Dionysius of Halicarnassus, Apollonius of Pergamus, and Theodore of Gadara. But of these nothing now remains upon the subject of oratory, except some tracts of Dionysius, who flourished in the reign of Augustus Cæsar. Nor have there been wanting some eminent writers of this kind among the Greeks since the time of Quintilian: two of whom we cannot omit to mention, Hermogenes, and Longinus the author of the incomparable treatise Of the Sublime, a book which can scarcely be too much commended or too often read.

3 Rise and progress of oratory in Rome.

It was long before Rome received this art, and not without difficulty at first. The reason was, because the Romans were for several ages wholly addicted to military affairs, and to enlarge their territories; so that they not only neglected to cultivate learning, but thought the pursuit of it a thing of ill tendency, by diverting the minds of their youth from the cares and toils of war, to a more soft and indolent kind of life. Therefore so late as the year of their city 592, when by the industry of some Grecians the liberal arts began to flourish in Italy, a decree passed the senate, by which all philosophers and rhetoricians were ordered to depart out of Rome. But in a few years after, when Carneades, Critolaus, and Diogenes, who were not only philosophers but orators, came ambassadors from Athens to Rome, the Roman youth were so charmed with the eloquence of their harangues, that they could no longer be stopt from pursuing the study of oratory. And by a further acquaintance with the Greeks, it soon gained such esteem, that persons of the first quality employed their time and pains to acquire it. And a young gentleman, who was ambitious to advance himself in the service of his country, could have little hopes of success, unless he had laid the foundation of his future prospects in that study.

Seneca tells us, that Lucius Plotius, a Gaul, was the first who taught the art of oratory at Rome in Latin; which, Cicero says, was while he was a boy; and when the most studious persons went to hear him, he lamented that he could not go with them; being prevented by the regard he paid to the opinion of some of his friends, who thought that greater improvements were made by exercises in the Greek language under Grecian masters. Seneca adds, that this profession continued for some time in the hands of freedmen; and that the first Roman who engaged in it was Blandus of the equestrian order, who was succeeded by others; some of whose lives are yet extant, written by Suetonius, as many of the Grecians are by Philostratus and Eunapius. Quintilian likewise gives us the names of those among the Romans, who wrote upon the art. "The first (he says) as far as I can learn, who composed any thing upon this argument, was M. Cato the censor. After him Antony the orator began upon the subject, which is the only work he has left, and that imperfect. Then followed some of less note. But he who carried eloquence to its highest pitch among us, was Cicero; who has likewise by his rules given the best plan both to practise and teach the art. After whom modesty would require us to mention no more, had he not told us himself that his books of rhetoric slipt out of his hands, while he was but a youth. And those lesser things, which many persons want, he has purposely omitted in his discourses of oratory. Cornificius wrote largely upon the same subject; Stertinius and Gallio the father, each of them something. But Celsus and Lenas were more accurate than Gallio; and in our times Virginius, Pliny, and Rutilius. And there are at this day some celebrated authors of the same kind, who, if they had taken in every thing, might have saved my pains." Time has since deprived us of most of the writers mentioned here by Quintilian. But we have the less reason to regret this loss, since it has preserved to us Cicero's treatises upon this subject; which we may well suppose to have been chiefly owing to their own excellency, and the great esteem they have always had in the world. Besides his Two books of Invention, which Quintilian here calls his Books of Rhetoric, there are extant of his, Three books of an Orator; one Of famous Orators; and another, which is called The Orator; as also his Topics, a preface Concerning the best sort of Orators, and a treatise Of the parts of Oratory. Each of which treatises, whether we regard the justness and delicacy of the thoughts, the usefulness of the rules, or the elegance and beauty of the style, deserves to be frequently perused by all who are lovers of eloquence. For who can be thought so well qualified to give the rules of any art, as he who excelled all mankind in the practice of them? But those Four Books to Herennius, which are published among Cicero's works, seem with good reason to be attributed to Cornificius, whom Quintilian here mentions. And Celsus is by some affirmed to to have taught oratory, whom he also places among the rhetoricians, and whose Eight Books of Medicine are yet extant, written in so beautiful a stile as plainly shows him to be a master of eloquence. But Quintilian himself outdid all who went before him in diligence and accuracy as a writer. His Institutions are so comprehensive, and written with such great exactness and judgment, that they are generally allowed to be the most perfect work of the kind. With this excellent author we shall finish the account of the Latin rhetoricians.

There were indeed some others in the following ages, whose works are yet extant; but as they contain nothing of moment which is not to be found in those already mentioned, we shall forbear to name them. Much less shall we descend to that numerous body of writers, who since the revival of learning have treated upon this subject, for the same reason. And a very good judge* has not long since given it as his opinion, that the method of forming the best system of oratory, is to collect it from the finest precepts of Aristotle, Cicero, Quintilian, Longinus, and other celebrated authors; with proper examples taken from the choicest parts of the purest antiquity. And this is the method attempted to be pursued in the following treatise.

* Archbp. Cambray, *Lett.* p. 213.

§ 2. *Of the Nature of Oratory.*

The terms *rhetoric* and *oratory*, having no other difference but that one is taken from the Greek language and the other from the Latin, may be used promiscuously, but the case is not the same with respect to the words *rhetorician* and *orator*. For although the Grecians used the former, both to express those who taught the art, and those who practised it; yet the Romans afterward, when they took that word into their language, confined it to the teachers of the art, and called the rest *orators*. And there seems to have been a sufficient reason for this distinction, since the art was the same in both, and might therefore go by either name: but the different province of rhetoricians and orators made it not improper that they should be called by different names. Besides, anciently, before rhetoric was made a separate and distinct art from philosophy, the same persons taught both. And then they were called not only *rhetoricians* but *sophists*. But because they often employed their art rather to vindicate what was false and unjust, than to support truth and virtue; this disingenuous conduct, by which they frequently imposed upon weak minds, brought a discredit both upon themselves and their profession. And therefore the name *sophist* or *sophister*, has been more generally used in an ill sense, to signify one skilled rather in the arts of cavilling, than qualified to speak well and accurately upon any subject.

4 Oratory an art.

It is not necessary to use many words, to prove that oratory is an art. For it is comprised under certain rules, agreeable to reason, delivered in a regular method, and suited to attain the end it proposes; which are characters sufficient to denominate it an art. Indeed the case is the same here as in most other things, that a good genius is of itself more serviceable than the most exact acquaintance with all the rules of art, where that is wanting. But it is sufficient that art help nature, and carry it farther than it can otherwise advance without it. And he who is desirous to gain the reputation of a good orator, will find the assistance of art very necessary. Some persons have thought, that many of the common systems written upon the subject of oratory have been attended with this inconvenience, that, by burdening the mind with too great a number of rules about things of less importance, they have oftentimes rather discouraged than promoted the study of eloquence. This undoubtedly is an extreme which should be always carefully avoided. But, however, an indifferent guide in a strange road is better than none at all. It may be worth while to hear Quintilian's opinion upon this head. "I would not (says he) have young persons think they are sufficiently instructed, if they have learned one of those compends which are commonly handed about, and fancy themselves safe in the decrees, as it were, of these technical writers. The art of speaking requires much labour, constant study, a variety of exercise, many trials, the greatest prudence, and readiness of thought. However, these treatises are useful, when they set you in a plain and open way, and do not confine you to one narrow track, from which he who thinks it a crime to depart must move as slowly as one that walks upon a rope." We see he is not for having us confine ourselves too closely to systems, though he thinks they are of service at first, till use and experience render them less necessary.

5 The object of it.

The business of oratory is to teach us to speak well; which, as Cicero explains it, is to speak *justly*, *methodically*, *floridly*, and *copiously*.

Now, in order to speak *justly*, or pertinently, a person must be master of his subject, that he may be able to say all that is proper, and avoid whatever may appear foreign and trifling. And he must clothe his thoughts with such words and expressions as are most suited to the nature of the argument, and will give it the greatest force and evidence.

And as it teaches to speak justly, so likewise *methodically*. This requires, that all the parts of a discourse be placed in their proper order, and with such just connexion, as to reflect a light upon each other, and thereby to render the whole both clear in itself, and easy to be retained. But the same method is not proper for all discourses. And very frequently a different manner is convenient in handling the same subject. For it is plain, that art, as well as nature, loves variety; and it discovers the speaker's judgment, when the disposition of his discourse is so framed, as to appear easy and natural, rather than the effect of industry and labour.

To speak *floridly*, is so peculiar a property of this art, that some have wholly confined it to the pomp and ornaments of language. But that it extends farther, and respects things as well as words, we shall have occasion to show hereafter. It contains indeed the whole subject of elocution, but does not wholly consist in it. True and solid eloquence requires not only the beauties and flowers of language, but likewise the best sense and clearest reasoning. Besides, rhetoric gives rules for the several sorts of style, and directs the use of them agreeably to the nature of the subject.

But the force of oratory appears in nothing more than a *copiousness* of expression, or a proper manner of enlargement, suited to the nature of the subject; which is of great use in persuasion, and forms the last property, required by Cicero, of speaking well. A short and concise

cise account of things is often attended with obscurity, from an omission of some necessary circumstances relating to them. Or, however, where that is not the case, yet for want of proper embellishments to enliven the discourse, and thereby to excite and fix the hearers attention, it is apt to slip through their minds without leaving any impression. But where the images of things are drawn in their full proportion, painted in their proper colours, set in a clear light, and represented in different views, with all the strength and beauties of eloquence, they captivate the minds of the audience with the highest pleasure, engage their attention, and by an irresistible force move and bend them to the design of the speaker.

The principal end and design of oratory is to persuade: for which reason it is frequently called the *art of persuasion*. Indeed the orator has often other subordinate views; as when he endeavours either to delight his hearers with what is pleasant and agreeable, or to conciliate their good opinion by a smooth and artful address; but still both these are in order to persuade and excite them to action.

An objection may, perhaps, hence be formed against eloquence, as an art which may be employed for persuading to ill as well as to good. There is no doubt that it may; and so reasoning may also be, and too often is, employed for leading men into error. But who would think of forming an argument from this against the cultivation of our reasoning powers? Reason, eloquence, and every art which ever has been studied among mankind, may be abused, and may prove dangerous in the hands of bad men: but it were perfectly childish to contend, that upon this account they ought to be abolished.

While the orator employs his art in pursuing only those ends for which it was at first designed, the persuading men to good and virtuous actions, and dissuading them from every thing that is ill and vicious; nothing can be more commendable in itself, or useful to human societies.

§ 3. *Of the Division of Oratory.*

8 Oratory consists of four parts.

Oratory consists of four parts; *invention, disposition, elocution*, and *pronunciation*. This will appear by considering the nature of each of them, and what it contributes in forming an orator. Every one who aims to speak well and accurately upon any subject, does naturally, in the first place, inquire after and pursue such thoughts as may seem most proper to explain and illustrate the thing upon which he designs to discourse. And if the nature of it requires that he should bring reasons to confirm what he says, he not only seeks the strongest, and such as are like to be best received; but also prepares to answer any thing which may be offered to the contrary. This is *invention*.—After this he deliberates with himself in what method to dispose of those things which have occurred to his mind, that they may appear in the plainest light, and not lose their force by disorder and confusion. This is the business of *disposition*.—His next concern is to give his thoughts an agreeable dress; by making choice of the fittest words, clearest expressions, smooth and harmonious periods, with other ornaments of style, as may best suit the nature of his subject, brighten his discourse, and render it most entertaining to his hearers. And this is called *elocution*.—The last thing he attends to, is to deliver what he has thus composed, with a just and agreeable *pronunciation*. And daily experience convinces us, how much this contributes both to engage the attention and impress what is spoken upon the mind. This then is the method which nature directs, in order to qualify ourselves for discoursing to the best advantage: Though by custom and habit these things become so familiar to us, that we do not always attend to them separately in their natural order. However, it is the business of art to follow nature, and to treat of things in that manner which she dictates.

PART I. OF INVENTION.

Chap. I. *Of Invention in general; and particularly of Common Places, and State of a Cause.*

7 Invention the discovery of such things as are fitted to persuade.

INVENTION, considered in general, is the discovery of such things as are proper to persuade. And in order to attain this end, the orator proposes to himself three things: To prove or illustrate the subject upon which he treats; to conciliate the mind of his hearers; and to engage their passions in his favour. And as these require different kinds of arguments or motives, invention furnishes him with a supply for each of them, as will be shown in their order.

An argument, as defined by Cicero, is a reason which induces us to believe what before we doubted of.

And as different kinds of discourses require different arguments, rhetoricians have considered them two ways; in general, under certain heads, as a common fund for all subjects; and, in a more particular manner, as they are suited to *demonstrative, deliberative*, or *judicial* discourses. At present we shall treat only upon the former of these. And now, that one thing may receive proof and confirmation from another, it is necessary that there be some relation between them; for all things are not equally adapted to prove one another. Thus, in measuring the quantity of two things which we would show to be either equal or unequal, if they are of such a nature that one cannot be applied to the other, then we take a third thing, which may be applied to them both; and that must be equal at least to one of the two, which if applied to the other, and found equal to that also, we presently conclude that these two things are equal; but if it be unequal to the other, we say that these two things are unequal. Because it is the certain and known property of all quantities, that whatsoever two things are equal to a third, are equal to one another; and where one of any two things is equal to a third, and the other unequal, those two things are unequal to one another. What has been said of quantities, will

Invention. will hold true in all other cases, that so far as any two things or ideas agree to a third, so far they agree to one another. So likewise, on the contrary, as far as one of any two things or ideas does agree to a third, and the other does not, so far they disagree with one another; in which respect, one of them cannot be truly affirmed of the other. Since, therefore, in every proposition, one thing is spoken of another, if we would find out whether the two ideas agree to each other or not, where this is not evident of itself, we must find out some third thing, the idea of which agrees to one of them; and then that being applied to the other, as it does agree or disagree with it, so we may conclude, that the two things proposed do agree or disagree with one another. This will be made more clear by an example or two. Should it be inquired, *Whether virtue is to be loved;* the argument between virtue and love might be found by comparing them separately with happiness, as a common measure to both. For since the idea of happiness agrees to that of love, and the idea of virtue to that of happiness; it follows, that the ideas of virtue and love agree to one another: and therefore it may be affirmed, *That virtue is to be loved.* But, on the contrary, because the idea of misery disagrees with that of love, but the idea of vice agrees to that of misery, the two ideas of vice and love must consequently disagree with one another; and therefore it would be false to assert, *That vice is to be loved.*

8 These called arguments.

Now, this third thing logicians call the *medium*, or *middle term*, because it does as it were connect two extremes; that is, both parts of a proposition. But rhetoricians call it an *argument*, because it is so applied to what was before proposed, as to become the instrument of procuring our assent to it. Thus far as to the nature and use of arguments. We shall next explain by what methods they are to be sought.

A lively imagination, and readiness of thought, are undoubtedly a very great help to invention. Some persons are naturally endued with that quickness of fancy, and penetration of mind, that they are seldom at a loss for arguments either to defend their own opinions, or to attack their adversaries. However, these things being the gift of nature, and not to be gained by art, do not properly fall under our present consideration.

9 Learning necessary to an orator.

It will be readily granted, that great learning and extensive knowledge are a noble fund for invention. An orator therefore should be furnished with a stock of important truths, solid maxims of reason, and a variety of knowledge, collected and treasured up both from observation and a large acquaintance with the liberal arts, that he may not only be qualified to express himself in the most agreeable manner, but likewise to support what he says with the strongest and clearest arguments.

But because all are not born with a like happy genius, and had not the same opportunity to cultivate their minds with learning and knowledge; and because nothing is more difficult than to dwell long upon the consideration of one thing, in order to find out the strongest arguments which may be offered for and against it; upon these accounts, art has prescribed a method to lessen, in some measure, these difficulties, and help every one to a supply of arguments upon any subject. And this is done by the contrivance of *common places*, which Cicero calls the *seats* or *heads of arguments*, and by a Greek name *topics*. They are of two sorts, *internal* and *external*. Invention.

10 Rules of art to supply the place of extensive learning or acute genius.

I. *Internal topics.* Though things, with regard to their nature and properties, are exceedingly various, yet they have certain common relations, by means whereof the truth of what is either affirmed or denied concerning them in any respect may be evinced. The ancient Greek rhetoricians therefore reduced these relations to some general heads, which are termed *loci* or *common places;* because the reasons or arguments suited to prove any proposition are reposited in them, as a common fund or receptacle. And they are called *internal heads*, because they arise from the subject upon which the orator treats; and are therefore distinguished from others named *external*, which he fetches from without, and applies to his present purpose, as will be shown hereafter. Cicero and Quintilian make them 16; three of which comprehend the whole thing they are brought to prove, namely, *definition*, *enumeration*, and *notation:* of the remaining 13, some contain a part of it, and the rest its various properties and circumstances, with other considerations relating to it; and these are, *genus*, *species*, *antecedents*, *consequents*, *adjuncts*, *conjugates*, *cause*, *effect*, *contraries*, *opposites*, *similitude*, *dissimilitude*, and *comparison*.

Definition explains the nature of the thing defined, and shows what it is. And to whatsoever the definition agrees, the thing defined does so likewise. If therefore Socrates be a rational creature, he is a man; because it is the definition of a man, that he is a rational creature.

Enumeration takes in all the parts of a thing. And from this we prove, that what agrees to all the parts agrees to the whole; and what does not agree to any one or more parts, does not agree to the whole: As when Cicero proves to Piso that all the Roman state hated him, by enumerating the several ranks and orders of Roman citizens who all did so.

Notation, or etymology, explains the meaning or signification of a word. From which we reason thus: "If he cannot pay his debts, he is insolvent;" for that is the meaning of the word *insolvent*.

Genus is what contains under it two or more sorts of things, differing in nature. From this head logicians reason thus: "Because every animal is mortal, and man is an animal, therefore man is mortal." But orators make a further use of this argument, which they call *ascending from the hypothesis to the thesis;* that is, from a particular to a general: As should a person, when speaking in praise of justice, take occasion from thence to commend and show the excellency of virtue in general, with a view to render that particular virtue more amiable. For since every species contains in it the whole nature of the genus to which it relates, besides what is peculiar to itself, whereby it is distinguished from it; what is affirmed of the genus, must of necessity be applicable to the species.

Species is that which comprehends under it all the individuals of the same nature. From hence we may argue, "He is a man, therefore he has a rational soul." And orators sometimes take occasion from this head to descend from the thesis to the hypothesis; that

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that is, in treating upon what is more general, to introduce some particular contained under it, for the greater illustration of the general.

Antecedents are such things, as being once allowed, others necessarily, or very probably, follow. From this head an inseparable property is proved from its subject: as, It is material, and therefore corruptible.

Consequents are such things as, being allowed, necessarily or very probably infer their antecedents. Hence the subject is proved from an inseparable property, in this manner: It is corruptible, and therefore material.

Adjuncts are separable properties of things, or circumstances that attend them. These are very numerous, and afford a great variety of arguments, some of which usually occur in every discourse. They do not necessarily infer their subject; but, if fitly chosen, render a thing credible, and are a sufficient ground for assent. The way of reasoning from them we shall show presently.

Conjugates are words deduced from the same origin with that of our subject. By these the habit is proved from its acts: as, He who does justly is just. He does not act wisely, therefore he is not wise. But this inference will not hold, unless the actions appear continued and constant.

A *cause* is that, by the force of which a thing does exist. There are four kinds of causes, matter, form, efficient, and end, which afford a great variety of arguments. The way of reasoning from them is to infer the effect from the cause: as, Man is endued with reason, therefore he is capable of knowledge.

An *effect* is that which arises from a cause, therefore the cause is proved by it: as, He is endued with knowledge, therefore with reason.

Contraries are things, which, under the same genus, are at the utmost distance from each other; so that what we grant to the one, we utterly deny the other; as, Virtue ought to be embraced, therefore vice should be avoided.

Opposites are such things, which, though repugnant, to each other, yet are not directly contradictory; as, To love and to injure, to hate and to commend. They differ from contraries in this, that they do not absolutely exclude one another. An argument is drawn from things repugnant, thus: He will do a man a mischief, therefore he does not love him. He loves a man, therefore he will not reproach him.

Similitude is an agreement of things in quality. Thus Cicero proves, that pernicious citizens ought to be taken out of the state, by the likeness they bear to corrupted members, which are cut off to prevent further damage to the body.

Dissimilitude is a disagreement of things in quality. From this head Cicero shows the preference of his own exile to Piso's government of Macedonia; by the difference between their conduct, and the people's esteem of them.

Comparison is made three ways: for either a thing is compared with a greater, with a less, or with its equal. This place, therefore, differs from that of similitude on this account, that the quality was considered in that, but here the quantity. An argument from the greater is thus drawn: If five legions could not conquer the enemy, much less will two.

11 The manner of reasoning from these heads.

We shall just give one example of the manner of reasoning from these heads, whereby the use of them may farther appear. If any one, therefore, should have endeavoured to persuade Cicero not to accept of his life upon the condition offered him by Antony, That he would burn his Philippic orations which had been spoken against him, he might be supposed to use such arguments as these; partly taken from the adjuncts of Cicero, partly from those of Antony, and partly from the thing itself. And first, with regard to Cicero, it might be said, That so great a man ought not to purchase his life at so dear a price as the loss of that immortal honour which by so great pains and labour he had acquired. And this might be confirmed by another argument, That now he was grown old, and could not expect to live much longer. And from the character of Antony he might argue thus; That he was very crafty and deceitful; and only designed, by giving him hopes of life, to have the Philippics first burnt, which otherwise he knew would transmit to posterity an eternal brand of infamy upon him, and then he would take off the author. And this might be shown by comparison. For since he would not spare others, who had not so highly exasperated him, and from whom he had not so much to fear, certainly he would not forgive Cicero, since he knew well enough, that so long as he lived, he himself could never be in safety. And, lastly, An argument might also be fetched from the nature of the thing itself in the following manner: That Cicero, by this action, would shamefully betray the state, and the cause of liberty, which he had through his whole life most courageously defended, with so great honour to himself, and advantage to the public. Upon such an account, a person might have used these or the like arguments with Cicero, which arise from the fore-mentioned heads.

12 They are of no solid utility unless there is a previous foundation of learning and genius.

From this account of common places, it is easy to conceive what a large field of discourse they open to the mind upon every subject. At the same time, though we have mentioned them from our respect for the orators of Greece and Rome, we heartily subscribe to the opinion of a celebrated modern, who gives of them the following account.

"The Grecian sophists were the first inventors of this artificial system of oratory; and they showed a prodigious subtility and fertility in the contrivance of these loci. Succeeding rhetoricians, dazzled by the plan, wrought them into so regular a system, that one would think they meant to teach how a person might mechanically become an orator, without any genius at all. They gave him receipts for making speeches on all manner of subjects. At the same time, it is evident, that though this study of common places might produce very showy academical declamations, it could never produce useful discourses on real business. The loci indeed supplied a most exuberant fecundity of matter. One who had no other aim, but to talk copiously and plausibly, by consulting them on every subject, and laying hold of all that they suggested, might discourse without end; and that, too, though he had none but the most superficial knowledge of his subject. But such discourse could be no other than trivial. What is truly solid and persuasive, must be drawn *ex visceribus causæ*, from a thorough knowledge of the subject, and profound meditation on it. They who would direct students of oratory

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tory to any other sources of argumentation, only delude them; and by attempting to render rhetoric too perfect an art, they render it, in truth, a trifling and childish study."

13 Of external topics, generally called *testimonies*.

II. *Of external topics.* When the orator reasons from such topics as do not arise from his subject, but from things of a different nature, these are called *external*. They are all taken from authorities, and are by one general name called *testimonies*.

Now a testimony may be expressed by writing, speech, or any other sign proper to declare a person's mind. And all testimonies may be distinguished into two sorts, divine and human. A divine testimony, when certainly known to be such, is incontestable, and admits of no debate, but should be acquiesced in without hesitation. Indeed the ancient Greeks and Romans esteemed the pretended oracles of their deities, the answers of their augurs, and the like fallacies, divine testimonies: but with us no one can be ignorant of their true notion, though they do not so directly come under our present consideration. Human testimonies, considered as furnishing the orator with arguments, may be reduced to three heads; *writings*, *witnesses*, and *contracts*.

14 Reduced to three heads, and separately explained.

1. By *Writings*, here, are to be understood written laws, wills, or other legal instruments, expressed and conveyed in that manner. And it is not so much the force and validity of such testimonies considered in themselves, that is here intended, as the occasion of dispute which may at any time arise concerning their true design and import, when produced in proof upon either side of a controversy. And these are five; Ambiguity, Disagreement between the words and intention, Contrariety, Reasoning, and Interpretation.

A writing is then said to be ambiguous, when it is capable of two or more senses, which makes the writer's design uncertain. Now ambiguity may arise either from single words, or the construction of sentences. From single words; as when either the sense of a word, or the application of it, is doubtful. As, should it be questioned, whether ready money ought to be included under the appellation of chattels left by a will; or, if a testator bequeath a certain legacy to his nephew Thomas, and he has two nephews of that name. But ambiguity is also sometimes occasioned from the construction of a sentence; as when several things or persons having been already mentioned, it is doubtful to which of them that which follows ought to be referred. For example, a person writes thus in his will: 'Let my heir give as a legacy to Titius a horse out of my stable, which he pleases.' Here it may be questioned, whether the word *he* refers to the heir or to Titius; and consequently, whether the heir be allowed to give Titius which horse he pleases, or Titius may choose which he likes best. Now as to controversies of this kind, in the first case above mentioned, the party who claims the chattels may plead, that all moveable goods come under that name, and therefore that he has a right to the money. This he will endeavour to prove from some instances where the word has been so used. The business of the opposite party is to refute this, by showing that money is not here included. And if either side produce precedents in his favour, the other may endeavour to show that the cases are not parallel. As to the second case, arising from an ambiguity in the name, if any other words or expressions in the will seem to countenance either of the claimants, he will not fail to interpret them to his advantage. So likewise, if any thing said by the testator, in his lifetime, or any regard shown to either of these nephews more than the other, may help to determine which of them was intended, a proper use may be made of it. And the same may be said with regard to the third case. In which the legatee may reason likewise from the common use of language, and show that in such expressions it is usual to make the reference to the last or next antecedent; and from thence plead, that it was the design of the testator to give him the option. But in answer to this, it may be said, that allowing it to be very often so, yet in this instance it seems more easy and natural to repeat the verb *give* after *pleases*, and so to supply the sentence, which *he pleases to give him*, referring it to the heir, than to bring in the verb *choose*, which was not in the sentence before; and so, by supplying the sense, *which he pleases to choose*, to give the option to Titius. But where controversies of this kind arise from a law, recourse may be had to other laws where the same thing has been expressed with greater clearness; which may help to determine the sense of the passage in dispute.

A second controversy from writings is, when one party adheres to the words, and the other to what he asserts was the writer's intention. Now he who opposes the literal sense either contends, that what he himself offers is the simple and plain meaning of the writing, or that it must be so understood in the particular case in dispute. An instance of the former is this, as we find it in Cicero. A person who died without children, but left a widow, had made this provision in his will: "If I have a son born to me, he shall be my heir." And a little after: "If my son die before he comes of age, let Curius be my heir." There is no son born: Curius therefore sues for the estate, and pleads the intention of the testator, who designed him for his heir, if he should have no son who arrived at age; and says, there can be no reason to suppose he did not intend the same person for his heir if he had no son, as if he should have one who afterwards died in his minority. But the heir at law insists upon the words of the will; which, as he says, require, that first a son should be born, and afterwards die under age, before Curius can succeed to the inheritance; and there being no son, a substituted heir, as Curius was, can have no claim where the first heir does not exist, from whom he derives his pretension, and was to succeed by the appointment of the will.—Of the latter case, rhetoricians give this example: "It was forbidden by a law to open the city gates in the night. A certain person notwithstanding, in time of war, did open them in the night, and let in some auxiliary troops, to prevent their being cut off by the enemy, who was posted near the town." Afterwards, when the war was over, this person is arraigned, and tried for his life, on account of this action. Now, in such a case, the prosecutor founds his charge upon the express words of the law; and pleads, that no sufficient reason can be assigned for going contrary to the letter of it, which would be to make a new law, and not to execute one already made. The defendant, on the other hand, alleges, That the fact he is charged with

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with cannot, however, come within the intention of the law; since he either could not, or ought not, to have complied with the letter of it in that particular case, which must therefore necessarily be supposed to have been excepted in the design of that law when it was made. But to this the prosecutor may reply, That all such exceptions as are intended by any law, are usually expressed in it: and instances may be brought of particular exceptions expressed in some laws; and if there be any such exception in the law under debate, it should especially be mentioned. He may further add, That to admit of exceptions not expressed in the law itself, is to enervate the force of all laws, by explaining them away, and in effect to render them useless. And this he may further corroborate, by comparing the law under debate with others, and considering its nature and importance, and how far the public interest of the state is concerned in the due and regular execution of it; from whence he may infer, that should exceptions be admitted in other laws of less consequence, yet, however, they ought not in this. Lastly, He may consider the reason alleged by the defendant, on which he founds his plea, and show there was not that necessity of violating the law in the present case, as is pretended. And this is often the more requisite, because the party who disputes against the words of the law, always endeavours to support his allegations from the equity of the case. If, therefore, this plea can be enervated, the main support of the defendant's cause is removed. For as the former arguments are designed to prevail with the judge, to determine the matter on this side the question from the nature of the case; so the intention of this argument is to induce him to it, from the weakness of the defence made by the opposite party. But the defendant will, on the contrary, use such arguments as may best demonstrate the equity of his cause, and endeavour to vindicate the fact from his good design and intention in doing it. He will say, That the laws have allotted punishments for the commission of such facts as are evil in themselves, or prejudicial to others; neither of which can be charged upon the action of which he is accused: That no law can be rightly executed, if more regard be had to the words and syllables of the writing, than to the intention of the legislator. To which purpose he may allege that direction of the law itself, which says, "The law ought not to be too rigorously interpreted, nor the words of it strained; but the true intention and design of each part of it duly considered." As also that saying of Cicero, "What law may not be weakened and destroyed, if we bend the sense to the words, and do not regard the design and view of the legislator?" Hence he may take occasion to complain of the hardship of such a procedure, that no difference should be made between an audacious and wilful crime, and an honest or necessary action, which might happen to disagree with the letter of the law, though not with the intent of it. And as it was observed before to be of considerable service to the accuser, if he could remove the defendant's plea of equity, so it will be of equal advantage to the defendant, if he can fix upon any words in the law, which may in the least seem to countenance his case, since this will take off the main force of the charge.

The third controversy of this kind is, when two writings happen to clash with each other, or at least seem to do so. Of this Hermogenes gives the following instance. One law enjoins: "He who continues alone in a ship during a tempest, shall have the property of the ship." Another law says, "A disinherited son shall enjoy no part of his father's estate." Now a son, who had been disinherited by his father, happens to be in his father's ship in a tempest, and continues there alone, when every one else had deserted it. He claims the ship by the former of these laws, and his brother tries his right with him by the latter. In such cases, therefore, it may first be considered, "Whether the two laws can be reconciled. And if that cannot be done, then, Which of them appears more equitable. Also, Whether one be positive and the other negative: because prohibitions are a sort of exceptions to positive injunctions. Or, If one be a general law, and the other more particular, and come nearer to the matter in question. Likewise, Which was last made: since former laws are often abrogated, either wholly or in part, by subsequent laws, or at least were designed to be so. Lastly, it may be observed, Whether one of the laws be not plain and express; and the other more dubious, or has any ambiguity in it. All, or any of which things, that party will not omit to improve for his advantage whose interest is concerned in it.

The fourth controversy is *reasoning*. As when something, not expressly provided for by a law, is inferred by a similitude, or parity of reason, from what is contained in it. Quintilian mentions this instance of it. "There was a law made at Tarentum, to prohibit the exportation of wool; but a certain person exports sheep." In this case, the prosecutor may first compare the thing which occasions the charge, with the words of the law, and show their agreement, and how unnecessary it was that particular thing should have been expressly mentioned in the law, since it is plainly contained in it, or at least an evident consequence from it. He may then plead, that many things of a like nature are omitted in other laws for the same reason. And, lastly, He may urge the reasonableness and equity of the procedure. The defendant, on the other hand, will endeavour to show the deficiency of the reasoning, and the difference between the two cases. He will insist upon the plain and express words of the law, and set forth the ill tendency of such inferences and conclusions drawn from similitudes and comparisons, since there is scarce any thing but in some respect may bear a resemblance to another.

The last controversy under this head is *interpretation*, in which the dispute turns upon the true meaning and explication of the law in reference to that particular case. We have the following instance of this in the Pandects: "A man who had two sons both under age, substitutes Titius as heir to him who should die last, provided both of them died in their minority. They both perish together at sea before they came to age. Here arises a doubt, whether the substitution can take place, or whether the inheritance devolves to the heir at law." The latter pleads, That as neither of them can be said to have died last, the substitution cannot take place; which was suspended, upon the condition that one died after the other. But

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2. The *second* head of external arguments are *Witnesses*. These may either give their evidence, when absent, in writing subscribed with their name; or present, by word of mouth. And what both of them testify, may either be from hearsay; or what they saw themselves, and were present at the time it was done. As the weight of the evidence may be thought greater or less on each of these accounts, either party will make such use of it as he finds for his advantage. The characters of the witnesses are also to be considered; and if any thing be found in their lives or behaviour that is justly exceptionable, to invalidate their evidence, it ought not to be omitted. And how they are affected to the contending parties, or either of them, may deserve consideration; for some allowances may be judged reasonable in case of friendship, or enmity, where there is no room for any other exception. But regard should chiefly be had to what they testify, and how far the cause is affected by it. Cicero is very large upon most of these heads in his defence of Marcus Fonteius, with a design to weaken the evidence of the Gauls against him. And where witnesses are produced on one side only, as orators sometimes attempt to lessen the credit of this kind of proof, by pleading that witnesses are liable to be corrupted, or biassed by some prevailing interest or passion, to which arguments taken from the nature and circumstances of things are not subject; it may be answered on the other hand, that sophistical arguments and false colourings are not exposed to infamy or punishment, whereas witnesses are restrained by shame and penalties, nor would the law require them if they were not necessary.

3. The *third* and last head of external arguments are *Contracts;* which may be either public or private. By public are meant the transactions between different states, as leagues, alliances, and the like; which depend on the laws of nations, and come more properly under deliberative discourses, to which we shall refer them. Those are called *private*, which relate to lesser bodies or societies of men, and single persons; and may be either written or verbal. And it is not so much the true meaning and purport of them that is here considered as their force and obligation. And, as the Roman law declares, "Nothing can be more agreeable to human faith, than that persons should stand to their agreements." Therefore in controversies of this kind, the party whose interest it is that the contract should be maintained, will plead, that such covenants have the force of private laws, and ought religiously to be observed, since the common affairs of mankind are transacted in that manner; and therefore to violate them, is to destroy all commerce and society among men. On the other side it may be said, that justice and equity are chiefly to be regarded, which are immutable; and besides, that the public laws are the common rule to determine all differences, which are designed to redress those who are aggrieved. And indeed, where a compact has been obtained by force or fraud, it is in itself void, and has no effect either in law or reason. But on the other hand, the Roman lawyers seem to have very rightly determined, that all such obligations as are founded on natural equity, though not binding by national laws, and are therefore called *nuda pacta*, ought, however, in honour and conscience, to be performed.

15 Of the state of a controversy, or the manner of referring the principal question in dispute to some particular head for greater ease of argument.

III. *Of the State of a Controversy.* The ancients, observing that the principal question or point of dispute in all controversies might be referred to some particular head, reduced these heads to a certain number, that both the nature of the question might by that means be better known, and the arguments suited to it be discovered with greater ease. And these heads they call *states*.

By the state of a controversy, then we are to understand the principal point in dispute between contending parties, upon the proof of which the whole cause or controversy depends. We find it expressed by several other names in ancient writers: as, the *constitution of the cause*, the *general head*, and the *chief question*. And as this is the principal thing to be attended to in every such discourse; so it is what first requires the consideration of the speaker, and should be well fixed and digested in his mind, before he proceeds to look for arguments proper to support it. Thus Antony, the Roman orator, speaking of his own method in his pleading, says: "When I understand the nature of the cause, and begin to consider it, the first thing I endeavour to do is, to settle with myself what that is to which all my discourse relating to the matter in dispute ought to be referred: then I diligently attend to these other two things, How to recommend myself, or those for whom I plead, to the good esteem of my hearers; and how to influence their minds, as may best suit my design." This way of proceeding appears very agreeable to reason and prudence. For what can be more absurd, than for a person to attempt the proof of any thing, before he has well settled in his own mind a clear and distinct notion what the thing is which he would endeavour to prove? Quintilian describes it to be, 'That kind of question which arises from the first conflict of causes.' In judicial cases, it immediately follows upon the charge of the plaintiff, and plea of the defendant. Our common law expresses it by one word, namely the *issue*. Which interpreters explain, by describing it to be, "That point of matter depending in suit, whereupon the parties join, and put their cause to the trial." Examples will further help to illustrate this, and render it more evident. In the cause of Millo, the charge of the Clodian party is, *Milo killed Clodius*. Milo's plea or defence, *I killed him, but justly*. From hence arises this grand question, or state of the cause, *Whether it was lawful for Milo to kill Clodius?* And that Clodius was lawfully killed by Milo, is what Cicero in his defence of Milo principally endeavours to prove. This is the main subject of that fine and beautiful oration. The whole of his discourse is to be considered as centering at last in this one point. Whatever different matters are occasionally mentioned, will, if closely attended to, be found to have been introduced some way or other the better to support and carry on this design. Now in such cases, where the fact is not denied, but something is offered in its defence, the state of the cause is taken from the defendant's plea, who is obliged to make it good: As in the instance here given, the chief point in dispute was the lawfulness of Milo's action, which it was Cicero's business to demonstrate. But when the defendant denies the fact, the state of of the cause arises from the accusation; the proof of which then lies upon the plaintiff, and not, as in the former case, upon the defendant. So in the cause of Roscius, the charge made against him is, *That he killed his father*. But he denies the fact. The grand question therefore to be argued is, *Whether or not he killed his father:* The proof of this lay upon his accusers. And Cicero's design in his defence of him is to show, that they had not made good their charge. But it sometimes happens, that the defendant neither absolutely denies the fact, nor attempts to justify it; but only endeavours to qualify it, by denying that it is a crime of that nature, or deserves that name, by which it is expressed in the charge. We have an example of this proposed by Cicero: "A person is accused of sacrilege, for taking a thing, that was sacred, out of a private house. He owns the fact, but denies it to be sacrilege; since it was committed in a private house, and not in a temple." Hence this question arises, *Whether to take a sacred thing out of a private house, is to be deemed sacrilege, or only simple theft?* It lies upon the accuser to prove what the other denies; and therefore the state of the cause is here also, as well as in the preceding case, taken from the indictment.

But besides the principal question, there are other subordinate questions, which follow upon it in the course of a dispute, and should be carefully distinguished from it. Particularly that which arises from the reason, or argument, which is brought in proof of the principal question. For the principal question itself proves nothing, but is the thing to be proved, and becomes at last the conclusion of the discourse. Thus, in the cause of Milo, his argument is, *I killed Clodius justly, because he assassinated me.* Unless the Clodian party be supposed to deny this, they give up their cause. From hence therefore this subordinate question follows, *Whether Clodius assassinated Milo!* Now Cicero spends much time in the proof of this, as the hinge on which the first question, and consequently the whole cause, depended. For if this was once made to appear, the lawfulness of Milo's killing Clodius, which was the grand question or thing to be proved, might be inferred as an allowed consequence from it. This will be evident, by throwing Milo's argument, as used by Cicero, into the form of a syllogism.

> *An assassin is lawfully killed:*
> *Clodius was an assassin:*
> *Therefore he was lawfully killed by Milo whom he assassinated.*

If the minor proposition of this syllogism was granted, no one would deny the conclusion: for the Romon law allowed of self-defence. But as Cicero was very sensible this would not be admitted, so he takes much pains to bring the court into the belief of it. Now where the argument brought in defence of the second question is contested, or the orator supposes that it may be so, and therefore supports that with another argument, this occasions a third question consequent upon the former; and in like manner he may proceed to a fourth. But be they more or fewer, they are to be considered but as one chain of subordinate questions dependent upon the first. And though each of them has its particular state, yet none of these is what rhetoricians call *The state of the Cause*, which is to be understood only of the principal question. And if, as it frequently happens, the first or principal question is itself directly proved from more than one argument; this makes no other difference, but that each of these arguments, so far as they are followed by others to support them, become a distinct series of subordinate questions, all dependent upon the first. As when Cicero endeavours to prove, that Roscius did not kill his father, from two reasons or arguments: *Because he had neither any cause to move him to such a barbarous action, nor any opportunity for it.*

Moreover, besides these subordinate questions, there are also incidental ones often introduced, which have some reference to the principal question, and contribute towards the proof of it, though they are not necessarily connected with it, or dependent upon it. And each of these also has its state, though different from that of the cause. For every question, or point of controversy, must be stated, before it can be made the subject of disputation. And it is for this reason, that every new argument advanced by an orator is called a *question;* because it is considered as a fresh matter of controversy. In Cicero's defence of Milo, we meet with several of this sort of questions, occasioned by some aspersions which had been thrown out by the Clodian party to the prejudice of Milo. As, "That he was unworthy to see the light, who owned he had killed a man:" For Milo before his trial had openly confessed he killed Clodius. So likewise, "That the senate had declared the killing of Clodius was an illegal action." And further, "That Pompey, by making a new law to settle the manner of Milo's trial, had given his judgment against Milo." Now to each of these Cicero replies, before he proceeds to the principal question. And therefore, though the question, in which the state of a controversy consists, is said by Quintilian to arise from "the first conflict of causes," yet we find by this instance of Cicero, that it is not always the first question in order, upon which the orator treats.

But it sometimes happens, that the same cause or controversy contains in it more than one state. Thus in judicial causes, every distinct charge occasions a new state. All Cicero's orations against Verres relate to one cause, founded upon a law of the Romans against unjust exactions made by their governors of provinces upon the inhabitants; but as that persecution is made up of as many charges as there are orations, every charge, or indictment, has its different state. So likewise his oration in defence of Cœlius has two states, in answer to a double charge made against him by his adversaries: one, "for borrowing money of Clodia, in order to bribe certain slaves to kill a foreign ambassador;" and the other, "for an attempt afterwards to poison Clodia herself." Besides which, there were several other matters of a less heinous nature, which had been thrown upon him by his accusers, with a design, very likely, to render the two principal charges more credible; to which Cicero first replies, in the same manner as in his defence of Milo.

Though all the examples we have hitherto brought to illustrate this subject have been taken from judicial cases, yet not only these, but very frequently discourses of the deliberative kind, and sometimes those of the demonstrative, are managed in a controversial way.

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And all controversies have their state. And therefore Quintilian very justly observes, that "states belong both to general and particular questions; and to all sorts of causes, demonstrative, deliberative, and judicial." In Cicero's oration for the Manilian law, this is the main point in dispute between him and those who opposed that law: "Whether Pompey was the fittest person to be intrusted with the management of the war against Mithridates?" This is a subject of the deliberative kind. And of the same nature was that debate in the senate concerning the demolition of Carthage. For the matter in dispute between Cato, who argued for it, and those who were of the contrary opinion, seems to have been this: "Whether it was for the interest of the Romans to demolish Carthage?" And so likewise in those two fine orations of Cato and Cæsar, given us by Sallust, relating to the conspirators with Catiline, who were then in custody, the controversy turns upon this: "Whether those prisoners should be punished with death, or perpetual imprisonment?" Examples of the demonstrative kind are not so common; but Cicero's oration concerning the 'Answers of the soothsayers,' may afford us an instance of it. Several prodigies had lately happened at Rome; upon which the soothsayers being consulted, assigned this as the reason of them, Because some places consecrated to the gods had been afterwards converted to civil uses. Clodius charged this upon Cicero; whose house was rebuilt at the public expence, after it had been demolished by Clodius, and the ground consecrated to the goddess Liberty. Cicero in this oration retorts the charge; and shows that the prodigies did not respect him, but Clodius. So that the question in dispute was, "To which of the two those prodigies related?" This oration does not appear to have been spoken in a judicial way, and must therefore belong to the demonstrative kind. His invective against Piso is likewise much of the same nature, wherein he compares his own behaviour and conduct with that of Piso.

As to the number of these states, both Cicero and Quintilian reduce them to three. "We must (says Quintilian) agree with those whose authority Cicero follows, who tells us, that three things may be inquired into in all disputes: Whether a thing is; what it is; and how it is. And this is the method which nature prescribes. For, in the first place, it is necessary the thing should exist about which the dispute is: because no judgment can be made either of its nature or quality till its existence be manifest; which is therefore the first question. But though it be manifest that a thing is, it does not presently appear what it is; and when this is known, the quality yet remains: and after these three are settled, no farther inquiry is necessary." Now the first of these three states is called the *conjectural state*; as if it be inquired, "Whether one person killed another?" This always follows upon the denial of a fact by one of the parties; as was the case of Roscius. And it receives its name from hence, that the judge is left, as it were, to conjecture, whether the fact was really committed or not, from the evidence produced on the other side. The second is called the *definitive state*, when the fact is not denied; but the dispute turns upon the nature of it, and what name it is proper to give it: as in that example of Cicero, "Whether to take a sacred thing out of a private house be theft or sacrilege?" For in this case it is necessary to settle the distinct notion of those two crimes, and show their difference. The third is called the *state of quality*; when the contending parties are agreed both as to the fact, and the nature of it; but the dispute is, "Whether it be just or unjust, profitable or unprofitable, and the like;" as in the cause of Milo.

From what has been said upon this subject, the use of it may in a good measure appear. For whoever engages in a controversy, ought in the first place to consider with himself the main question in dispute, to fix it well in his mind, and keep it constantly in his view; without which he will be very liable to ramble from the point, and bewilder both himself and his hearers. And it is no less the business of the hearers principally to attend to this; by which means they will be helped to distinguish and separate from the principal question what is only incidental, and to observe how far the principal question is affected by it; to perceive what is offered in proof, and what is only brought in for illustration; not to be misled by digressions, but to discern when the speaker goes off from his subject, and when he returns to it again; and, in a word, to accompany him through the whole discourse, and carry with them the principal chain of reasoning upon which the cause depends, so as to judge upon the whole, whether he has made out his point, and the conclusion follows from the premises.

Chap. II. *Of Arguments suited to Demonstrative Discourses.*

16 Of arguments suited to demonstrative discourses.

These consist either in praise or dispraise; and, agreeably to the nature of all contraries, one of them will serve to illustrate the other.

Now we either praise *persons* or *things*.

I. In praising or dispraising *persons*, rhetoricians prescribe two methods. One is, to follow the order in which every thing happened that is mentioned in the discourse; the other is, to reduce what is said under certain general heads, without a strict regard to the order of time.

1. In pursuing the former method, the discourse may be very conveniently divided into three periods. The first of which will contain what preceded the person's birth; the second, the whole course of his life; and the third what followed upon his death.

Under the first of these may be comprehended what is proper to be said concerning his country or family. And therefore, if these were honourable, it may be said to his advantage, that he nowise disgraced them, but acted suitably to such a descent. But if they were not so, they may be either wholly omitted; or it may be said, that, instead of deriving thence any advantage to his character, he has conferred a lasting honour upon them; and that is not of so much moment where, or from whom, a person derives his birth, as how he lives.

In the second period, which is that of his life, the qualities both of his mind and body, with his circumstances in the world, may be separately considered. Though, as Quintilian rightly observes, "All external advantages are not praises for themselves, but according to the use that is made of them. For riches, and power, and interest, as they have great influence, and may be applied either to good or bad purposes, are a

Invention. a proof of the temper of our minds; and therefore we are either made better or worse by them." But these things are a just ground for commendation, when they are the reward of virtue or industry. Bodily endowments are health, strength, beauty, activity, and the like; which are more or less commendable, according as they are employed. And where these, or any of them, are wanting, it may be shown, that they are abundantly compensated by the more valuable endowments of the mind. Nay, sometimes a defect in these may give an advantageous turn to a person's character; for any virtue appears greater, in proportion to the disadvantages the person laboured under in exerting it. But the chief topics of praise are taken from the virtues and qualifications of the mind. And here the orator may consider the disposition, education, learning, and several virtues, which shone through the whole course of the person's life. In doing which, the preference should always be given to virtue above knowledge or any other accomplishment. And in actions, those are most considerable, and will be heard with greatest approbation, which a person either did alone, or first, or wherein he had fewest associates; as likewise those which exceeded expectation, or were done for the advantage of others rather than his own. And further, as the last scene of a man's life generally commands the greatest regard, if any thing remarkable at that time was either said or done, it ought particularly to be mentioned. Nor should the manner of his death, or cause of it, if accompanied with any commendable circumstances, be omitted; as if he died in the service of his country, or in the pursuit of any other laudable design.

The third and last period relates to what followed after the death of the person. And here the public loss, and public honours conferred upon the deceased, are proper to be mentioned. Sepulchres, statues, and other monuments to perpetuate the memory of the dead at the expence of the public, were in common use both among the Greeks and Romans. But in the earliest times, as these honours were more rare, so they were less costly. For as in one age it was thought a sufficient reward for him who died in the defence of his country, to have his name cut in a marble inscription, with the cause of his death; so in others it was very common to see the statues of gladiators, and persons of the meanest rank, erected in public places. And therefore a judgment is to be formed of these things from the time, custom, and circumstances, of different nations; since the frequency of them renders them less honourable; and takes off from their evidence as the rewards of virtue. But, as Quintilian says, "Children are an honour to their parents, cities to their founders, laws to those who compiled them, arts to their inventors, and useful customs to the authors of them."

And this may suffice for the method of praising persons when we propose to follow the order of time, as Isocrates has done in his funeral oration upon Evagoras king of Salamis, and Pliny in his panegyric upon the emperor Trajan. But as this method is very plain and obvious, so it requires the more agreeable dress to render it delightful; lest otherwise it seem rather like a history than an oration: For which reason, we find, that epic poets, as Homer, Virgil, and others, begin with the middle of their story, and afterwards take a proper occasion to introduce what preceded, to diversify the subject, and give the greater the pleasure and entertainment to their readers. Invention.

2. The other method above hinted was, to reduce the discourse to certain general heads, without regarding the order of time. As if any one, in praising the elder Cato, should propose to do it, by showing that he was a most prudent senator, an excellent orator, and most valiant general; all which commendations are given him by Pliny. In like manner, the character of a good general may be comprised under four heads; skill in military affairs, courage, authority, and success: from all which Cicero commends Pompey. And agreeably to this method Suetonius has written the lives of the first twelve Cæsars.

But in the praising of persons, care should always be taken to say nothing that may seem fictitious or out of character, which may call the orator's judgment or integrity in question. It was not without cause, therefore, that Lysippus the statuary, as Plutarch tells us, blamed Apelles for painting Alexander the Great with thunder in his hand; which could never suit his character as a man, however he might boast of his divine descent: for which reason Lysippus himself made an image of him holding a spear, as the sign of a warrior. Light and trivial things in commendations are likewise to be avoided, and nothing mentioned but what may carry in it the idea of something truly valuable, and which the hearers may be supposed to wish for, and is proper to excite their emulation. These are the principal heads of praise with relation to men. In dispraise, the heads contrary to these are requisite; which being sufficiently clear from what has been said, need not particularly be insisted on.

II. We proceed therefore to the other part of the division, which respect *things*, as distinguished from persons. By which we are to understand all beings inferior to man, whether animate or inanimate; as likewise the habits and dispositions of men, either good or bad, when considered separately, and apart from their subjects, as arts and sciences, virtues and vices, with whatever else may be a proper subject for praise or dispraise. Some writers, indeed, have, for their own amusement and the diversion of others, displayed their eloquence in a jocose manner upon subjects of this kind. So Lucian has written in praise of a fly, and Synesius an elegant encomium upon baldness. Others, on the contrary, have done the like in a satirical way. Such is Seneca's apotheosis or consecration of the emperor Claudius; and the Mysopogon or beard-hater, written by Julian the emperor. Not to mention several modern authors, who have imitated them in such ludicrous compositions. But as to these things, and all of the like nature, the observation of Antony in Cicero seems very just: "That it is not necessary to reduce every subject we discourse upon to rules of art." For many are so trivial, as not to deserve it; and others so plain and evident of themselves, as not to require it. But since it frequently comes in the way both of orators and historians to describe countries, cities, and facts, we shall briefly mention the principal heads of invention proper to illustrate each of these.

Countries, then, may be celebrated from the pleasantness

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santness of their situation, the clemency and wholesomeness of the air, and goodness of the soil; to which last may be referred the springs, rivers, woods, plains, mountains, and minerals. And to all these may be added their extent, cities, the number and antiquity of the inhabitants; their policy, laws, customs, wealth, character for cultivating the arts both of peace and war; their princes, and other eminent men they have produced. Thus Pacatus has given us a very elegant description of Spain, in his panegyric upon the emperor Theodosius, who was born there.

Cities are praised from much the same topics as countries. And here, whatever contributes either to their defence or ornament ought particularly to be mentioned; as the strength of the walls and fortifications, the beauty and splendour of the buildings, whether sacred or civil, public or private. We have in Herodotus a very fine description of Babylon, which was once the strongest, largest, and most regular city in the world. And Cicero has accurately described the city of Syracuse, in the island Sicily, in one of his orations against Verres.

But facts come much oftener under the cognizance of an orator. And these receive their commendation from their honour, justice, or advantage. But in describing them, all the circumstances should be related in their proper order; and that in the most lively and affecting manner suited to their different nature. Livy has represented the demolition of Alba by the Roman army, which was sent thither to destroy it, through the whole course of that melancholy scene, in a style so moving and pathetic, that one can hardly forbear condoling with the inhabitants, upon reading his account.

But in discourses of this kind, whether of praise or dispraise, the orator should (as he ought indeed upon all occasions) well consider where, and to whom, he speaks. For wise men often think very differently both of persons and things from the common people. And we find that learned and judicious men are frequently divided in their sentiments, from the several ways of thinking to which they have been accustomed. Besides, different opinions prevail, and gain the ascendant, at different times. While the Romans continued a free nation, love of their country, liberty, and public spirit, were principles in the highest esteem among them. And therefore, when Cato killed himself, that he might not fall into the hands of Cæsar, and survive the liberty of his country, it was thought an instance of the greatest heroic virtue; but afterwards, when they had been accustomed to an arbitrary government, and the spirit of liberty was now lost, the poet Martial could venture to say,

Death to avoid 'tis madness sure to die.

A prudent orator therefore will be cautious of opposing any settled and prevailing notions of those whom he addresses, unless it be necessary; and then he will do it in the softest and most gentle manner.

Chap. III. *Of Arguments suited to Deliberative Discourses.*

This kind of discourses must certainly have been very ancient; since, doubtless, from the first beginning of men's conversing together, they deliberated upon their common interest, and offered their advice to each other. But neither those of the laudatory nor judicial kind could have been introduced, till mankind were settled in communities, and found it necessary to encourage virtue by public rewards, and bring vice under the restraint of laws. The early practice of suasory discourses appears from sacred writ, where we find, that when Moses was ordered upon an embassy into Egypt, he would have excused himself for want of eloquence. And Homer represents the Greeks at the siege of Troy, as flocking like a swarm of bees to hear their generals harangue them. Nor is this part of oratory less conspicuous for its usefulness to mankind, than for its antiquity; being highly beneficial either in councils, camps, or any societies of men. How many instances have we upon record, where the fury of an enraged multitude has been checked and appeased by the prudent and artful persuasion of some particular person? The story of Agrippa Menenius, when the commons of Rome withdrew from the senators, and retired out of the city, is too well known to need reciting. And how often have armies been animated and fired to the most dangerous exploits, or recalled to their duty, when ready to mutiny, by a moving speech of their general? many instances of which we find in history.

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Of deliberative discourses, and the arguments suited to them.

All deliberation respects something future, for it is in vain to consult about what is already past. The subject matter of it is, either things public or private, sacred or civil; indeed all the valuable concerns of mankind, both present and future, come under its regard. And the end proposed by this kind of discourses is chiefly profit or interest. But since nothing is truly profitable but what is in some respect good; and every thing which is good in itself may not in all circumstances be for our advantage; properly speaking, what is both good and profitable, or beneficial good, is the end here designed. And therefore, as it sometimes happens, that what appears profitable may seem to interfere with that which is strictly just and honourable; in such cases it is certainly most adviseable to determine on the safer side of honour and justice, notwithstanding some plausible things may be offered to the contrary. But where the dispute lies apparently between what is truly honest, and some external advantage proposed in opposition to it, all good men cannot but agree in favour of honesty. Such was the case of Regulus, who, being taken prisoner by the Carthaginians, was permitted to go to Rome upon giving his oath, that unless he could persuade the senate to set at liberty some young Carthaginian noblemen, then prisoners at Rome, in exchange for him, he should return again to Carthage. But Regulus, when he came to Rome, was so far from endeavouring to prevail with the senate to comply with the desire of the Carthaginians, that he used all his interest to dissuade them from hearkening to the proposal. Nor could the most earnest entreaties of his nearest relations and friends, nor any arguments they were able to offer, engage him to continue at Rome, and not return again to Carthage. He had then plainly in his view, on the one side, ease, security, affluence, honours, and the enjoyment of his friends; and on the other, certain death, attended with cruel torments. However, thinking the former

former not consistent with truth and justice, he chose the latter. And he certainly acted as became an honest and brave man, in choosing death, rather than to violate his oath. Though whether he did prudently in persuading the senate not to make the exchange, or they in complying with him, we shall leave others to determine. Now, when it proves to be a matter of debate, whether a thing upon the whole be really beneficial or not; as here arise two parts, advice and dissuasion, they will each require proper heads of argument. But as they are contrary to each other, he who is acquainted with one, cannot well be ignorant of the other. We shall therefore chiefly mention those proper for advice, from whence such as are suited to dissuade will easily be perceived. Now the principal heads of this kind are these following, which are taken from the nature and properties of the thing itself under consideration.

1. *Pleasure* often affords a very cogent argument in discourses of this nature. Every one knows what an influence this has upon the generality of mankind. Though, as Quintilian remarks, pleasure ought not of itself to be proposed as a fit motive for action in serious discourses, but when it is designed to recommend something useful, which is the case here. So, would any one advise another to the pursuit of polite literature, Cicero has furnished him with a very strong inducement to it from the pleasure which attends that study, when he says, "If pleasure only was proposed by these studies, you would think them an entertainment becoming a man of sense and a gentleman. For other pursuits neither agree with all times, all ages, nor all places; but these studies improve youth, delight old age, adorn prosperity, afford a refuge and comfort in adversity, divert us at home, are no hinderance abroad, sleep, travel, and retire with us into the country."

2. *Profit*, or advantage. This has no less influence upon many persons than the former; and when it respects things truly valuable, it is a very just and laudable motive. Thus Cicero, when he sends his *Book of Offices* to his son, which he wrote in Latin for his use, advises him to make the best advantage both of his tutor's instructions and the conversation at Athens, where he then was; but withal to peruse his philosophical treatises, which would be doubly useful to him, not only upon account of the subjects, but likewise of the language, as they would enable him to express himself upon those arguments in Latin, which before had only been treated of in Greek.

3. *Honour;* than which no argument will sooner prevail with generous minds, or inspire them with greater ardour. Virgil has very beautifully described Hector's ghost appearing to Æneas the night Troy was taken, and advising him to depart, from this motive of honour:

> O goddess-born, escape by timely flight
> The flames and horrors of this fatal night.
> The foes already have possess'd the wall;
> Troy nods from high, and totters to her fall.
> Enough is paid to Priam's royal name;
> More than enough to duty and to fame.
> If by a mortal hand my father's throne
> Cou'd be defended, 'twas by mine alone.

The argument here made use of to persuade Æneas to leave Troy immediately, is, that he had done all that could be expected from him, either as a good subject or brave soldier, both for his king and country; which were sufficient to secure his honour; and now there was nothing more to be expected from him when the city was falling, and impossible to be saved; which, could it have been preserved by human power, he himself had done it.

But although a thing considered in itself appear beneficial if it could be attained, yet the expediency of undertaking it may still be questionable; in which case the following heads, taken from the circumstances which attend it, will afford proper arguments to engage in it.

(1.) The *possibility* of succeeding may sometimes be argued, as one motive to this end. So Hannibal endeavoured to convince King Antiochus, that it was possible for him to conquer the Romans, if he made Italy the seat of the war; by observing to him, not only that the Gauls had formerly destroyed their city, but that he had himself defeated them in every battle he fought with them in that country.

(2.) But an argument founded upon *probability* will be much more likely to prevail. For in many affairs of human life, men are determined either to prosecute them or not, as the prospect of success appears more or less probable. Hence Cicero, after the fatal battle at Pharsalia, dissuades those of Pompey's party, with whom he was engaged, from continuing the war any longer against Cæsar; because it was highly improbable, after such a defeat, by which their main strength was broken, that they should be able to stand their ground, or meet with better success than they had before.

(3.) But further, since probability is not a motive strong enough with many persons to engage in the prosecution of a thing which is attended with considerable difficulties, it is often necessary to represent the facility of doing it, as a further reason to induce them to it. And therefore Cicero makes use of this argument to encourage the Roman citizens in opposing Mark Antony (who upon the death of Cæsar had assumed an arbitrary power), by representing to them, that his circumstances were then desperate, and that he might easily be vanquished.

(4.) Again, If the thing advised can be shown to be in any respect necessary, this will render the motive still much stronger for undertaking it. And therefore Cicero joins this argument with the former, to prevail with the Roman citizens to oppose Antony, by telling them, that "The consideration before them was, not in what circumstances they should live, but whether they should live at all, or die with ignominy and disgrace." This way of reasoning will sometimes prevail when all others prove ineffectual. For some persons are not to be moved till things are brought to an extremity, and they find themselves reduced to the utmost danger.

(5.) To these heads may be added the consideration of the *event*, which in some cases carries great weight with it. As when we advise to the doing of a thing from this motive, That whether it succeed or not, it will yet be of service to undertake it. So after the great victory gained by Themistocles over the Persian fleet at the

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the straits of Salamis, Mardonius advised Xerxes to return into Asia himself, lest the report of his defeat should occasion an insurrection in his absence: but to leave behind him an army of 300,000 men under his command; with which, if he should conquer Greece, the chief glory of the conquest would redound to Xerxes; but if the design miscarried, the disgrace would fall upon his generals.

These are the principal heads which furnish the orator with proper arguments in giving advice. Cicero, in his oration for the Manilian law, where he endeavours to persuade the Roman people to choose Pompey for their general in the Mithridatic war, reasons from three of these topics, into which he divides his whole discourse; namely, the necessity of the war, the greatness of it, and choice of a proper general.—Under the first of these he shows, that the war was necessary, from four considerations; the honour of the Roman state, the safety of their allies, their own revenues, and the fortunes of many of their fellow citizens, which were all highly concerned in it, and called upon them to put a stop to the growing power of King Mithridates, by which they were all greatly endangered. So that this argument is taken from the head of *necessity*. The second, in which he treats of the greatness of the war, is founded upon the topic of *possibility*. For though he shows the power of Mithridates to be very great, yet not so formidable, but that he might be subdued; as was evident from the many advantages Lucullus had gained over him and his associates. In the third head, he endeavours to prevail with them to intrust the management of the war in the hands of Pompey, whom he describes as a consummate general, for his skill in military affairs, courage, authority, and success; in all which qualities he represents him as superior to any other of their generals whom they could at that time make choice of. The design of all which was, to persuade them, that they had very good reason to hope for success, and a happy event of the war, under his conduct. So that the whole force of his reasoning under this head is drawn from *probability*. These are the three general topics which make up that fine discourse. Each of which is indeed supported by divers other arguments and considerations, which will be obvious in perusing the oration itself, and therefore need not be here enumerated. On the contrary, in another oration he endeavours to dissuade the senate from consenting to a peace with Mark Antony, because it was base, dangerous, and impracticable.

But no small skill and address are required in giving advice. For since the tempers and sentiments of mankind, as well as their circumstances, are very different and various; it is often necessary to accommodate the discourse to their inclinations and opinions of things. And therefore the weightiest arguments are not always the most proper and fittest to be used on all occasions. Cicero, who was an admirable master of this art, and knew perfectly well how to suit what he said to the taste and relish of his hearers, in treating upon this subject, distinguishes mankind into two sorts; the ignorant and unpolished, who always prefer profit to honour; and such as are more civilized and polite, who prefer honour and reputation to all other things.—Wherefore they are to be moved by these different views: Praise, glory, and virtue, influence the one: while the other is only to be engaged by a prospect of gain and pleasure. Besides, it is plain, that the generality are much more inclined to avoid evils than to pursue what is good: and to keep clear of scandal and disgrace, than to practise what is truly generous and noble. Persons likewise of a different age act from different principles; young men for the most part view things in a different light from those who are older and have had more experience, and consequently are not to be influenced by the same motives.

Chap. IV. *Of Arguments suited to Judicial Discourses.*

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Of judicial discourses and the arguments suited to them.

In *judicial* controversies there are two parties; the plaintiff or prosecutor, and the defendant or person charged. The subject of them is always something past. And the end proposed by them Cicero calls *equity*, or *right* and *equity*; the former of which arises from the laws of the country, and the latter from reason and the nature of things. For at Rome the prætors had a court of equity, and were empowered, in many cases relating to property, to relax the rigour of the written laws. But as this subject is very copious, and causes may arise from a great variety of things, writers have reduced them to three heads, which they call *states*, to some one of which all judicial proceedings may be referred; namely, *whether a thing is*, *what it is*, or *how it is*. By the *state* of a cause, therefore, is meant the principal question in dispute, upon which the whole affair depends. Which, if it stops in the first inquiry, and the defendant denies the fact, the state is called *conjectural*; but if the fact be acknowledged, and yet denied to be what the adversary calls it, it is termed *definitive*; but if there is no dispute either about the fact or its name, but only the justice of it, it is called the *state of quality*: as was shown more largely before (see N° 15.). But we there considered these states only in a general view, and deferred the particular heads of argument proper for each of them to this *judicial* kind of discourses; where they most frequently occur, and from which examples may easily be accommodated to other subjects.

All judicial causes are either *private* or *public*. Those are called *private*, which relate to the right of particular persons; and they are likewise called *civil* causes, as they are conversant about matters of property.—*Public* causes are those which relate to public justice and the government of the state; which are also called *criminal*, because by them crimes are prosecuted, whether capital, or those of a less heinous nature. We shall take the heads of the arguments only from this latter kind, because they are more copious, and easy to be illustrated by examples; from which such as agree to the former, namely, *civil* causes, will sufficiently appear.

1. The *conjectural* state. When the accused person denies the fact, there are three things which the prosecutor has to consider; whether he *would* have done it, whether he *could*, and whether he *did* it. And hence arise three topics; from the *will*, the *power*, and the *signs* or circumstances which attended the action. The affections of the mind discover the will; as passion, an old grudge, a desire of revenge, a resentment

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sentiment of an injury, and the like. Therefore Cicero argues from Clodius's hatred of Milo, that he designed his death; and from thence infers, that he was the aggressor in the combat between them, wherein Clodius was killed. This is what he principally endeavours to prove, and comes properly under this state: for Milo owned that he killed him, but alleged that he did it in his own defence. So that in regard to this point, which of them assaulted the other? the charge was mutual. The prospect of advantage may also be alleged to the same purpose. Hence it is said of L. Cassius, that whenever he sat as judge in a case of murder, he used to advise and move the court to examine to whom the advantage arose from the death of the deceased. And Cicero puts this to Antony concerning the death of Cæsar. "If any one (says he) should bring you upon trial, and use that saying of Cassius *Cui bono?* 'Who got by it?' look to it, I beseech you, that you are not confounded. To these arguments may be added, hope of impunity, taken either from the circumstances of the accused person, or of him who suffered the injury. For persons, who have the advantage of interest, friends, power, or money, are apt to think they may easily escape; as likewise such who have formerly committed other crimes with impunity. Thus Cicero represents Clodius as hardened in vice, and above all the restraint of laws, from having so often escaped punishment upon committing the highest crimes. On the contrary, such a confidence is sometimes raised from the condition of the injured party, if he is indigent, obscure, timorous, or destitute of friends; much more if he has an ill reputation, or is loaded with popular hatred and resentment. It was this presumption of the obscurity of Roscius, who lived in the country, and his want of interest at Rome, which encouraged his accusers to charge him with killing his father, as Cicero shows in his defence of him. Lastly, The temper of a person, his views, and manner of life, are considerations of great moment in this matter. For persons of bad morals, and such as are addicted to vice, are easily thought capable of committing any wickedness. Hence Sallust argues from the evil disposition and vicious life of Catiline, that he affected to raise himself upon the ruins of his country.—The second head is the *power* of doing a thing: and there are three things which relate to this, the *place*, the *time*, and *opportunity*. As if a crime is said to have been committed in a private place, where no other person was present; or in the night; or when the injured person was unable to provide for his defence. Under this head may likewise be brought in the circumstances of the persons; as if the accused person was stronger, and so able to overpower the other; or more active, and so could easily make his escape. Cicero makes great use of this topic in the case of Milo, and shows, that Clodius had all the advantages of *place*, *time*, and *opportunity*, to execute his design of killing him. The third head comprehends the *signs* and circumstances which either preceded, accompanied, or followed, the commission of the fact. So threats, or the accused person being seen at or near the place before the fact was committed, are circumstances that may probably precede murder; fighting, crying out, bloodshed, are such as accompany it; paleness, trembling, inconsistent answers, hesitation, or faltering of the speech, something found upon the person accused which belonged to the deceased, are such as follow it. Thus Cicero proves, that Clodius had threatened the death of Milo, and given out that he should not live above three days at the farthest.—These arguments, taken from conjectures, are called *presumptions*, which, though they do not directly prove that the accused person committed the fact with which he is charged; yet when, laid together, they appeared very strong, sentence by the Roman law might sometimes be given upon them, to convict him.

These are the topics from which the prosecutor takes his arguments. Now the business of the defendant is to invalidate these. Therefore such as are brought from the *will*, he either endeavours to show are not true, or so weak as to merit very little regard. And he refutes those taken from the *power*, by proving that he wanted either opportunity or ability: as, if he can show, that neither the place nor time insisted on was at all proper; or that he was then in another place. In like manner he will endeavour to confute the *circumstances*, if they cannot be directly denied, by showing that they are not such as do necessarily accompany the fact, but might have proceeded from other causes, though nothing of what is alleged had been committed; and it will be of great service to assign some other probable cause. But sometimes the defendant does not only deny that he did the fact, but charges it upon another. Thus Cicero, in his oration for Roscius, not only defends him from each of these three heads, but likewise charges the fact upon his accusers.

2. The *definitive* state, which is principally concerned in defining and fixing the name proper to the fact: though orators seldom make use of exact definitions, but commonly choose larger descriptions, taken from various properties of the subject or thing described.

The heads of argument in this state are much the same to both parties. For each of them defines the fact his own way, and endeavours to refute the other's definition. We may illustrate this by an example from Quintilian: "A person is accused of sacrilege, for stealing money out of a temple, which belonged to a private person." The fact is owned; but the question is, *Whether it be properly sacrilege?* The prosecutor calls it so, because it was taken out of a temple. But since the money belonged to a private person, the defendant denies it to be sacrilege, and says it is only simple theft. Now the reason why the defendant uses this plea, and insists upon the distinction, is, because by the Roman law the penalty of theft was only four times the value of what was stolen? whereas sacrilege was punished with death. The prosecutor then forms his definition agreeable to his charge, and says, "To steal any thing out of a sacred place is sacrilege." But the defendant excepts against this definition, as defective; and urges, that it does not amount to sacrilege, unless the thing stolen was likewise sacred. And this case might once, perhaps, have been a matter of controversy, since we find it expressly determined in the Pandects, that "An action of sacrilege should not lie, but only of theft, against any one who should steal the goods of private persons deposited in a temple."

The second thing is the proof brought by each party to support his definition; as in the example given.

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given us by Cicero, of one "who carried his cause by bribery, and was afterwards prosecuted again upon an action of prevarication." Now, if the defendant was cast upon this action, he was, by the Roman law, subjected to the penalty of the former prosecution. Here the prosecutor defines prevarication to be, *Any bribery or corruption in the defendant, with a design to pervert justice*. The defendant, therefore, on the other hand, restrains it to *bribing only the prosecutor*.

And if this latter sense agrees better with the common acceptation of the word, the prosecutor in the third place pleads the intention of the law, which was to comprehend all bribery in judicial matters under the term of *prevarication*. In answer to which the defendant endeavours to show, either from the head of contraries, that a real prosecutor and a prevaricator are used as opposite terms in the law; or from the etymology of the word, that a prevaricator denotes one who pretends to appear in the prosecution of a cause, while in reality he favours the contrary side; and consequently, that money given for this end only can, in the sense of the law, be called *prevarication*.

Lastly, The prosecutor pleads, that it is unreasonable that he who does not deny the fact should escape by a cavil about a word. But the defendant insists upon his explication as agreeable to the law; and says, the fact is misrepresented and blackened, by affixing to it a wrong name.

3. The third state is that of *quality*, in which the dispute turns upon the justice of an action. And here the defendant does not deny he did the thing he is charged with; but asserts it to be right and equitable, from the circumstances of the case, and the motives which induced him to it.

And, first, He sometimes alleges, the reason of doing it was in order to prevent some other thing of worse consequence, which would otherwise have happened. We have an instance of this in the life of Epaminondas, who, with two other generals joined in the command with him, marched the Theban army into Peloponnesus against the Lacedæmonians; but by the influence of a contrary faction at home, their commissions were superseded, and other generals sent to command the army. But Epaminondas, being sensible that, if he obeyed this order at that time, it would be attended with the loss of the whole army, and consequently the ruin of the state, refused to do it; and having persuaded the other generals to do the like, they happily finished the war in which they were engaged; and upon their return home, Epaminondas taking the whole matter upon himself, on his trial was acquitted. The arguments proper in this case are taken from the justice, usefulness, or necessity, of the action. The accuser therefore will plead, that the fact was not just, profitable, nor necessary, considered either in itself or comparatively with that for the sake of which it is said to have been done: and he will endeavour to show, that what the defendant assigns for the reason of what he did might not have happened as he pretends. Besides, he will represent of what ill consequence it must be, if such crimes go unpunished. The defendant, on the other hand, will argue from the same heads, and endeavour to prove the fact was just, useful, or necessary. And he will further urge, that no just estimate can be made of any action, but from the circumstances which attend it; as the design, occasion, and motives for doing it, which he will represent in the most favourable light to his own cause, and endeavour to set them in such a view, as to induce others to think they could not but have done the same in the like circumstances.

Again, The cause of an action is sometimes charged by the defendant upon the party who received the damage, or some other person, who either made it necessary, or enjoined him to do it. The first of these was Milo's plea for killing Clodius, because he assaulted him with a design to take away his life. Here the fact is not denied, as in the case of Roscius above mentioned, under the *conjectural* state; but justified from the reason of doing it. For that an assassin might be justly killed, Cicero shows both from law and reason. The accuser, therefore, in such a case, will, if there be room for it, deny the truth of this allegation. So the friends of Clodius affirmed that Milo was the aggressor, and not Clodius; which Cicero, in his defence of Milo, principally labours to refute. In the second case, the prosecutor will say, No one ought to offend because another has offended first; which defeats the course of public justice, renders the laws useless, and destroys the authority of the magistrate. The defendant, on the other hand, will endeavour to represent the danger and necessity of the case, which required an immediate remedy, and in that manner; and urges, that it was vain and impracticable to wait for redress in the ordinary way, and therefore no ill consequence can arise to the public. Thus Cicero, in defending Sextius, who was prosecuted for a riot in bringing armed men into the forum, shows that his design was only to repel force with force; which was then necessary, there being no other means left for the people to assemble, who were excluded by a mob of the contrary party. Of the third case we have also an example in Cicero, who tells us, that, "in making a league between the Romans and Samnites, a certain young nobleman was ordered by the Roman general to hold the swine (designed for a sacrifice); but the senate afterwards disapproving the terms, and delivering up their general to the Samnites, it was moved, Whether this young man ought not likewise to be given up." Those who were for it might say, that, to allege the command of another, is not a sufficient plea for doing an ill action; and this is what the Roman law now expressly declares. But in answer to that, it might be replied, that it was his duty to obey the command of his general, who was answerable for his own orders, and not those who were obliged to execute them; and therefore, to give up this young nobleman would be to punish one person for the fault of another.

Lastly, A fact is sometimes rather excused than defended, by pleading that it was not done designedly, or with any ill intent. This is called *concession;* and consists of two parts, *apology* and *entreaty*. The former represents the matter as the effect of inadvertency, chance, or necessity. Aristotle gives us an example of inadvertency or imprudence in a woman at Athens, who gave a young man a love potion, which killed him; for which she was tried, but acquitted: though afterwards this was made criminal by the Roman law. The case of

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of Adrastus, as related by Herodotus, is an instance of chance; who being intrusted by Crœsus with the care of his son, as they were hunting, killed him accidentally with a javelin which he threw at a boar. It is necessity, when a person excuses his making a default, from stress of weather, sickness, or the like. Thus Cicero pleaded his illness, contracted by the fatigue of a long journey, as an excuse for not appearing in the senate upon the summons of Mark Antony, who threatened to oblige him to it by pulling his house down. But what the defendant here attributes to inadvertency, chance, or necessity, the opposite party will attribute to design, negligence, or some other culpable reason; and represent it as a matter injurious to the public to introduce such precedents; and also produce instances, if that can be done, where the like excuses have not been admitted. On the other hand, the defendant will insist on his innocence, and show the hardship and severity of judging men's actions rather by the event, than from the intention: that such a procedure makes no difference between the innocent and the guilty; but must necessarily involve many honest men in ruin and destruction, discourage all virtuous and generous designs, and turn greatly to the prejudice of human society. He will also consider the instances alleged by the accuser, and show the difference between them and his own case. And, lastly, He will have recourse to entreaty, or a submissive address to the equity and clemency of the court, or party offended, for pardon; as Cicero has done in his oration to Cæsar, in favour of Ligarius.

Chap. V. *Of the Character and Address of an Orator.*

19 Propriety of manners necessary in an orator, both with respect to character and address.

Having considered and explained the first part of Invention, which furnishes the orator with such arguments as are necessary for the proof of his subject, we are next to show what are the proper means to conciliate the minds of his hearers; to gain their affection; and to recommend both himself, and what he says, to their good opinion and esteem. For the parts of invention are commonly thus distinguished; that the first respects the *subject* of the discourse, the second the *speaker*, and the third the *hearers*. Now the second of these, what we have at present to explain, is by Quintilian called a *propriety of manners*. And in order to express this it is necessary, as he tells us, "that every thing apper easy and natural, and the disposition of the speaker be discovered by his words." We may form an easy conception of this from the conduct of such persons as are most nearly concerned in each others welfare. As when relations or friends converse together upon any affairs of importance, the temper and disposition of the speaker plainly shows itself by his words and manner of address. And what nature here directs to without colouring or disguise, the orator is to endeavour to perform by his art. Though indeed, if what a person says be inconsistent with his usual conduct and behaviour at other times, he cannot expect it should gain much credit, or make any deep impression upon his hearers; which may be one reason why the ancient rhetoricians make it so necessary a qualification in an orator, that he be a good man; since he should always be consistent with himself, and as we say, talk in character. And therefore it is highly requisite, that he should not only gain the skill of assuming those qualities which the nature and circumstances of his discourse require him to express; but, likewise, that he should use his utmost endeavours to get the real habits implanted in his mind. For as by this means they will be always expressed with greater ease and facility; so, by appearing constantly in the course of his life, they will have more weight and influence upon particular occasions.

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Now there are four qualities, more especially suited to the character of an orator, which should always appear in his discourses, in order to render what he says acceptable to his hearers; and these are *wisdom*, *integrity*, *benevolence*, and *modesty*.

1. *Wisdom* is necessary; because we easily give into those whom we esteem wiser and more knowing than ourselves. Knowledge is very agreeable and pleasant to all, but few make very great improvements in it; either by reason they are employed in other necessary affairs, and the mind of man cannot attend to many things at once; or because the way to knowledge at first is hard and difficult, so that persons either do not care to enter upon the pursuit of it, or, if they do, they are many times soon discouraged, and drop it, for want of sufficient resolution to surmount its difficulties. Such, therefore, as either cannot, or do not care to give themselves the trouble of examining into things themselves, must take up with the representation of others: and it is an ease to them to hear the opinion of persons whom they esteem wiser than themselves. No one loves to be deceived; and those who are fearful of being misled, are pleased to meet with a person in whose wisdom, as they think, they can safely trust. The character of wisdom therefore is of great service to an orator, since the greater part of mankind are swayed by authority rather than arguments.

2. But this of itself is not sufficient, unless the opinion of *integrity* be joined with it. Nay so far from it, that the greater knowledge and understanding a man is supposed to have, unless he likewise have the character of an honest man, he is often the more suspected. For knowledge without honesty, is generally thought to dispose a person, as well as qualify him, to deceive.

3. And to both these qualities the appearance of kindness and *benevolence* should likewise be added. For though a person have the reputation of wisdom and honesty, yet if we apprehend he is either not well affected to us, or at least regardless of our interest, we are in many cases apt to be jealous of him. Mankind are naturally swayed by their affections, and much influenced through love or friendship; and therefore nothing has a greater tendency to induce persons to credit what is said, than intimations of affection and kindness. The best orators have been always sensible what great influence the expressions of kindness and benevolence have upon the minds of others, to induce them to believe the truth of what they say; and therefore they frequently endeavour to impress them with the opinion of it. Thus Demosthenes begins his celebrated oration for Ctesiphon. "It is my hearty prayer (says he) to all the deities, that this my defence may be received by you with the same affection which I have always expressed for you and your city." And it is a very fine image of it which we have in Cicero, where,

Invention. where, in order to influence the judges in favour of Milo, he introduces him speaking thus, as became a brave man, and a patriot, even upon the supposition he should be condemned by them: "I bid my fellow citizens adieu: may they continue flourishing and prosperous; may this famous city be preserved, my most dear country, however it has treated me; may my fellow citizens enjoy peace and tranquillity without me, since I am not to enjoy it with them, though I have procured it for them: I will withdraw, I will be gone."

4. *Modesty*. It is certain, that what is modestly spoken is generally better received than what carries in it an air of boldness and confidence. Most persons, though ignorant of a thing, do not care to be thought so; and would have some deference paid to their understanding. But he who delivers himself in an arrogant and assuming way seems to upbraid his hearers with ignorance, while he does not leave them to judge for themselves, but dictates to them, and as it were demand their assent to what he says; which is certainly a very improper method to win upon them. For not a few, when convinced of an error in such a way, will not own it; but will rather adhere to their former opinion, than seem forced to think right, when it gives another the opportunity of a triumph. A prudent orator therefore will behave himself with modesty, that he may not seem to insult his hearers; and will set things before them in such an engaging manner, as may remove all prejudice either from his person or what he asserts. This is particularly necessary in the exordium of a discourse. If the orator set out with an air of arrogance and ostentation, the self-love and pride of the hearers will be presently awakened, and will follow him with a very suspicious eye throughout all his progress. His modesty should discover itself not only in his expressions at the beginning, but in his whole manner; in his looks, in his gestures, in the tone of his voice. Every auditory take in good part those marks of respect and awe, which are paid to them by one who addresses them. Indeed the modesty of an introduction should never betray any thing mean or abject. It is always of great use to an orator, that together with modesty and deference to his hearers, he should show a certain sense of dignity, arising from a persuasion of the justice or importance of the subject of which he is to speak. For to speak timorously, and with hesitation, destroys the credit of what is offered; and so far as the speaker seems to distrust what he says himself, he often induces others to do the like.

But, as has been said already, great care is to be taken that these characters do not appear feigned and counterfeit. For what is fictitious can seldom be long concealed. And if this be once discovered, it makes all that is said suspected, how specious soever it may otherwise appear.

It is further necessary, that the orator should know the world, and be well acquainted with the different tempers and dispositions of mankind. Nor indeed can any one reasonably hope to succeed in this province, without well considering the circumstances of time and place, with the sentiments and dispositions of those to whom he speaks; which, according to Aristotle, may be distinguished four ways, as they discover themselves by the several *affections*, *habits*, *ages*, and *fortunes*, of mankind. And each of these requires a different conduct and manner of address.

The *affections* denote certain emotions of the mind, which, during their continuance, give a great turn to the disposition. For love prompts to one thing, and hatred to another. The like may be said of anger, lenity, and the rest of them.

Persons differ likewise according to the various *habits* of their mind. So a just man is inclined one way, and an unjust man another; a temperate man to this, and an intemperate man to the contrary.

And as to the several *ages* of men, Aristotle has described them very accurately; and how persons are differently affected in each of them. He divides the lives of men, considered as hearers, into three stages; youth, middle age, and old age.—Young men, he says, have generally strong passions, and are very eager to obtain what they desire, but are likewise very mutable, so that the same thing does not please them long. They are ambitious of praise, and quick in their resentments: lavish of their money, as not having experienced the want of it: frank and open, because they have not often been deceived; and credulous for the same reason. They readily hope the best, because they have not suffered much, and are therefore not so sensible of the uncertainty of human affairs; for which reason they are likewise more easily deceived. They are modest, from their little acquaintance with the world. They love company and cheerfulness, from the briskness of their spirits. In a word, they generally exceed in what they do; love violently, hate violently, and act in the same manner through the rest of their conduct.—The disposition of old men is generally contrary to the former. They are cautious, and enter upon nothing hastily; having in the course of many years been often imposed upon; having often erred, and experienced the prevailing corruption of human affairs; for which reason they are likewise suspicious, and moderate in their affections either of love or hatred. They pursue nothing great and noble, and regard only the necessaries of life. They love money; having learned by experience the difficulty of getting it, and how easily it is lost. They are fearful, which makes them provident. Commonly full of complaints, from bodily infirmities, and a deficiency of spirits. They please themselves rather with the memory of what is past, than with any future prospect; having so short a view of life before them, in comparison of what is already gone: for which reason also, they love to talk of things past; and prefer them to what is present, of which they have but little relish, and know they must shortly leave them. They are soon angry, but not to excess. Lastly, They are compassionate, from a sense of their own infirmities, which makes them think themselves of all persons most exposed.—Persons of a middle age, betwixt these two extremes, as they are freed from the rashness and temerity of youth, so they have not yet suffered the decays of old age. Hence in every thing they generally observe a better conduct. They are neither so hasty in their assent as the one, nor so minutely scrupulous as the other, but weigh the reasons of things. They regard a decency in their actions; are careful and industrious; and as they undertake what appears just and laudable upon better and more deliberate consideration than young persons, so they pursue them

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them with more vigour and resolution than those who are older.

As to the different *fortunes* of mankind, they may be considered as noble, rich, or powerful; and the contrary to these. Those of high birth, and noble extraction, are generally very tender of their honour, and ambitious to increase it; it being natural for all persons to desire an addition to those advantages of which they find themselves already possessed. And they are apt to consider all others as much their inferiors, and therefore expect great regard and deference should be shown them.—Riches, when accompanied with a generous temper, command respect, from the opportunities they give of being useful to others; but they usually elate the mind, and occasion pride. For as money is commonly said to command all things, those who are possessed of a large share of it, expect others should be at their beck: since they enjoy that which all desire, and which most persons make the main pursuit of their lives to obtain.—But nothing is more apt to swell the mind than power. This is what all men naturally covet, even when perhaps they would not use it. But the views of such persons are generally more noble and generous than of those who only pursue riches and the heaping up of money. A state contrary to these gives a contrary turn of mind; and in lower life, persons dispositions usually differ according to their station and circumstances. A citizen and a courtier, a merchant and a soldier, a scholar and a peasant, as their pursuits are different, so is generally their turn and disposition of mind.

It is the orator's business, therefore, to consider these several characters and circumstances of life, with the different bias and way of thinking they give to the mind; that he may so conduct himself in his behaviour and manner of speaking, as will render him most acceptable, and gain him the good esteem of those whom he addresses.

Chap. VI. *Of the Passions.*

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It is necessary, though difficult, to engage the interest of the passions.

As it is often highly necessary for the orator, so it requires his greatest skill, to engage the passions in his interest. Quintilian calls this *the soul and spirit of his art.* And, doubtless, nothing more discovers its empire over the minds of men, than this power to excite, appease, and sway their passions, agreeably to the design of the speaker. Hence we meet with the characters of *admirable*, *divine*, and other splendid titles, ascribed to eloquence by ancient writers. It has indeed been objected by some, that whatever high encomiums may be given of this art by the admirers of it, it is however disingenuous to deceive and impose upon mankind, as those seem to do, who, by engaging their passions, give a bias to their minds, and take them off from the consideration of the truth; whereas every thing should be judged of from the reasons brought to support it, by the evidence of which it ought to stand or fall. But in answer to this, it may be considered that all fallacy is not culpable. We often deceive children for their good; and physicians sometimes impose on their patients to come at a cure. And why, therefore, when persons will not be prevailed with by reason and argument, may not an orator endeavour, by engaging their passions, to persuade them to that which is for their advantage? Besides, Quintilian makes it a necessary qualification of an orator, that he be an honest man, and one who will not abuse his art. But since those of a contrary character will leave no methods untried in order to carry their point, it is requisite for those who design well to be acquainted with all their arts, without which they will not be a match for them; as in military affairs it is highly advantageous for the general of an army to get himself informed of all the designs and stratagems of the enemy, in order to counteract them. Indeed this part of oratory is not necessary at all times, nor in all places. The better prepared persons are to consider truth, and act upon the evidence of it, the less occasion there appears for it. But the greater part of mankind either do not duly weigh the force of arguments, or refuse to act agreeably to their evidence. And where this is the case, that persons will neither be convinced by reason, nor moved by the authority of the speaker, the only way left to put them upon action, is to engage their passions. For the passions are to the mind, what the wind is to a ship: they move, and carry it forward; and he who is without them, is in a manner without action, dull and lifeless. There is nothing great or noble to be performed in life wherein the passions are not concerned. The Stoics, therefore, who were for eradicating the passions, both maintained a thing in itself impossible, and which, if it was possible, would be of the greatest prejudice to mankind. For while they appeared such zealous assertors of the government of reason, they scarce left it any thing to govern; for the authority of reason is principally exercised in ruling and moderating the passions, which, when kept in a due regulation, are the springs and motives to virtue. Thus hope produces patience, and fear industry; and the like might be shown of the rest. The passions therefore are not to be extirpated, as the Stoics asserted, but put under the direction and conduct of reason. Indeed where they are ungovernable, and resist the controul of reason, they are, as some have fitly called them, *diseases of the mind;* and frequently hurry men to vice, and the greatest misfortunes of life: just as the wind, when it blows moderately, carries on the ship; but if it be too boisterous and violent, may overset her. The charge therefore brought against this art, for giving rules to influence the passions, appears groundless and unjust; since the proper use of the passions is, not to hinder the exercise of reason, but engage men to act agreeably to reason. And if an ill use be sometimes made of this, it is not the fault of the art but of the artist.

We shall here consider the passions, as they may be separately referred, either to *demonstrative*, *deliberative*, or *judicial* discourses; though they are not wholly confined to any of them.

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Of the passions which may be referred to demonstrative discourses.

1. To the *demonstrative* kind, we may refer *joy* and *sorrow*, *love* and *hatred*, *emulation* and *contempt*.

Joy is an elation of the mind, arising from a sense of some present good. Such a reflection naturally creates a pleasant and agreeable sensation, which ends in a delightful calm and serenity. This is heightened by a description of former evils, and a comparison between them and the present felicity. Thus Cicero endeavours to excite in the minds of his fellow citizens the highest sense of joy and delight at Catiline's departure from Rome, by representing to them the imminent danger which threatened

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threatened both them and the city while he continued among them.

Sorrow, on the contrary, is an uneasiness of mind arising from a sense of some present evil. This passion has generally a place in funeral discourses. And it may be heightened, like the former, by comparison, when any past happiness is set in opposition to a present calamity. Hence Cicero aggravates the sorrow at Rome occasioned by the death of Metellus, from his character, and great services to the public, while living.

Love excites us to esteem any person for some excellency, and to do him all the good in our power. It is distinguished from *friendship*, which is mutual; and therefore love may continue where friendship is lost; that is, the affection may remain on one side. And when we assist a person from no other motive but to do him a kindness, Aristotle calls this *good-will*. Love takes its rise from a variety of causes. Generosity, benevolence, integrity, gratitude, courtesy, and other social virtues, are great incitements to love any one endued with such qualities. And persons generally love those who are of a like disposition with themselves, and pursue the same views. It is therefore the chief art of a flatterer to suit himself in every thing to the inclination of the person whose good graces he courts. When the orator would excite this affection towards any person, it is proper to show, that he is possessed of at least some, if not all, of these agreeable qualities. When the conspirators with Catiline were to be brought to justice, Cicero was very sensible of the envy he should contract on that account, and how necessary it was for him to secure the love of the Roman senate for his support and protection in that critical juncture. And this he endeavours to do in his fourth oration against Catiline, by representing to them in the most pathetic manner, that all the labours he underwent, the difficulties he conflicted with, and the dangers to which he was exposed on that account, were not for his own sake, but for their safety, quiet, and happiness.

Hatred is opposed to love, and produced by the contrary dispositions. And, therefore, persons hate those who never did them any injury, from the ill opinion they have of their base and vicious inclinations. So that the way to excite this passion is by showing that any one has committed some heinous fact with an ill intent. And the more nearly affected persons are by such actions, in what they account of the greatest concern, the higher in proportion their hatred rises. Since life, therefore, is esteemed the most valuable good, Cicero endeavours to render Mark Antony odious to the citizens of Rome, by describing his cruelty.

Emulation is a disquiet, occasioned by the felicity of another, not because he enjoys it, but because we desire the like for ourselves. So that this passion is in itself good and laudable, as it engages men to pursue those things which are so. For the proper objects of emulation are any advantages of mind, body, or fortune, acquired by study or labour.

Emulation therefore is excited by a lively representation of any desirable advantages which appear to be attainable, from the example of others who are or have been possessed of them. But where the felicity of another occasions an uneasiness, not from the want of it, but, because he enjoys it, this passion is called *envy*, which the ancients describe as a hideous monster, feeding upon itself, and being its own tormentor. Aristotle justly observes, that it most usually affects such persons as were once upon a level with those they envy. For most men naturally think so well of themselves, that they are uneasy to see those who were formerly their equals advanced above them. But as this is a base and vicious passion, the orator is not to be informed how to excite it, but how to lessen or remove it. And the method prescribed by Cicero for this purpose is, to show that the things which occasioned it have not happened to the envied person undeservedly, but are the just reward of his industry or virtue; that he does not so much convert them to his own profit or pleasure, as to the benefit of others; and that the same pains and difficulties are necessary to preserve them with which they were at first acquired.

Contempt is opposed to *emulation*, and arises from misconduct in things not of themselves vicious: As where a person either acts below his station and character, or affects to do that for which he is not qualified. Thus Cicero endeavours to expose Cæcilius, and bring him into contempt of the court, for pretending to rival him in the accusation of Verres, for which he was altogether unfit.

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Of the passions which may be referred to deliberative discourses.

2. To *deliberative* discourses may be referred *fear*, *hope*, and *shame*.

Fear arises from the apprehension of some great and impending evil. For the greatest evils, while they appear at a distance, do not much affect us. Such persons occasion fear, who are possessed of power, especially if they have been injured, or apprehend so: likewise those who are addicted to do injuries, or who bear us an ill will. And the examples of others, who have suffered in a like case, or from the same persons, help to excite fear. From the circumstances therefore either of the thing or person, it will not be difficult for the orator to offer such arguments as may be proper to awaken this passion. So Demosthenes, when he would persuade the Athenians to put themselves in a condition of defence against King Philip, enumerates the several acts of hostility already committed by him against the neighbouring states. And because men's private concerns generally more affect them than what relates to the public, it is proper sometimes to show the necessary connexion these have with each other, and how the ruin of one draws the other after it.

The contrary passion to *fear* is *hope*; which arises either from a prospect of some future good, or the apprehension of safety from those things which occasion our fear. Young persons are easily induced to hope the best, from the vigour of their spirits. And those who have escaped former dangers are encouraged to hope for the like success for the future. The examples of others also, especially of wise and considerate men, have often the same good effect. To find them calm and sedate when exposed to the like dangers, naturally creates confidence and the hopes of safety. But nothing gives persons such firmness and steadiness of mind under the apprehension of any difficulties, as a consciousness of their own integrity and innocence. Let dangers come from what quarter they will, they are best prepared

Invention. prepared to receive them. They can calmly view an impending tempest, observe the way of its approach, and prepare themselves in the best manner to avoid it. In Cicero's oration for the Manilian law, he encourages the Roman citizens to hope for success against Mithridates, if they chose Pompey for their general, from the many instances of his former successes which he there enumerates.

Shame arises from the apprehension of those things that hurt a person's character. *Modesty* has been wisely implanted in mankind by the great Author of nature, as a guardian of virtue, which ought for this reason to be cherished with the greatest care; because, as Seneca has well observed, "if it be once lost, it is scarce ever to be recovered." Therefore the true cause or foundation of shame is any thing base or vicious; for this wounds the character, and will not bear reflection. And he must arrive at no small degree of insensibility, who can stand against such a charge, if he be conscious to himself that it is just. Therefore, to deter persons from vicious actions, or to expose them for the commission of them, the orator endeavours to set them in such a light as may most awaken this passion, and give them the greatest uneasiness by the reflection. And because the bare representation of the thing itself is not always sufficient for this purpose, he sometimes enforces it by enlarging the view, and introducing those persons as witnesses of the fact for whom they are supposed to have the greatest regard. Thus, when some of the Athenians, in an arbitration about certain lands which had been referred to them by the contending parties, proposed it as the shortest way of deciding the controversy, to take the possession of them in their own hands; Cydias, a member of the assembly, to dissuade them from such an unjust action, desired them to imagine themselves at that time in the general assembly of the states of Greece (who would all hear of it shortly), and then consider how it was proper to act. But where persons labour under an excess of modesty which prevents them from exerting themselves in things fit and laudable, it may sometimes be necessary to shew that it is faulty and ill grounded. On the other hand, *immodesty*, or impudence, which consists in a contempt of such things as affect the reputation, can never be too much discouraged and exposed. And the way of doing this is to make use of such arguments as are most proper to excite shame. We have a very remarkable instance of it in Cicero's second Philippic, wherein he affixes this character upon Mark Antony through every scene of his life.

23
Of the passions which may be referred to *judicial* discourses.

3. To *judicial* discourses, may be referred *anger* and *lenity*, *pity* and *indignation*.

Anger is a resentment, occasioned by some affront or injury, done without any just reason. Now men are more inclined to resent such a conduct, as they think they less deserve it. Therefore persons of distinction and figure, who expect a regard should be paid to their character, can the less bear any indications of contempt. And those who are eminent in any profession or faculty, are apt to be offended if reflections are cast either upon their reputation or art. Magistrates also, and persons in public stations, sometimes think it incumbent on them to resent indignities for the support of their office. But nothing sooner inflames this passion, than if good services are rewarded with slights and neglect. The instance of Narses, the Roman general, is remarkable in this kind; who, after he had been successful in his wars with the Goths, falling under the displeasure of the emperor Justin, was removed from the government of Italy, and received by the empress with this taunt, *That he must be sent to weave among the girls;* which so provoked him, that he said he would weave such a web as they would never be able to unravel. And accordingly, he soon after brought down the Longobards, a people of Germany into Italy; where they settled themselves in that part of the country, which from them is now called *Lombardy*. (See NARSES). The time and place in which an injury was done, and other circumstances that attended it, may likewise contribute very much to heighten the fact. Hence Demosthenes, in his oration against Midias, endeavours to aggravate the injury of being struck by him, both as he was then a magistrate, and because it was done at a public festival. From hence it appears, that the persons who most usually occasion this passion are such as neglect the rules of decency, contemn and insult others, or oppose their inclinations; as likewise the ungrateful, and those who violate the ties of friendship, or requite favours with injuries. But when the orator endeavours to excite anger, he should be careful not to exceed due bounds in aggravating the charge, lest what he says appear rather to proceed from prejudice, than a strict regard to the demerit of the action.

Lenity is the remission of anger. The designs of men's actions are principally to be regarded; and therefore what is done ignorantly, or through inadvertency, is sooner forgiven. Also to acknowledge a fault, submit, and ask pardon, are the ready means to take off resentment. For a generous mind is soon cooled by submission. Besides, he who repents of his fault, does really give the injured party some satisfaction, by punishing himself; as all repentance is attended with grief and uneasiness of mind, and this is apt very much to abate the desire of revenge. As, on the contrary, nothing is more provoking, that when the offender either audaciously justifies the fact, or confidently denies it. Men are likewise wont to lay aside their resentment, when their adversaries happen by some other means to suffer what they think a sufficient satisfaction. Lastly, Easy circumstances, a lucky incident, or any thing which gives the mind a turn to mirth and pleasure, has a natural tendency to remove anger. For anger is accompanied with pain and uneasiness, which very ill suit joy and cheerfulness. The orator therefore, in order to assuage and pacify the minds of his auditors, will endeavour to lessen their opinion of the fault, and by that means to take off the edge of their resentment. And to this purpose, it will be proper either to represent that the thing was not designed, or that the party is sorry for it; or to mention his former services; as also to show the credit and reputation which will be gained by a generous forgiveness. And this last topic is very artfully wrought up by Cicero, in his address to Cæsar in favour of Ligarius.

Pity arises from the calamities of others, by reflecting, that we ourselves are liable to the like misfortunes. So that evils, considered as the common lot of human nature, are principally the cause of pity. And this makes the difference between *pity* and *good will*, which arises merely from a regard to the circumstances of those who want

Invention. want our assistance. But considering the uncertainty of every thing about us, he must seem in a manner divested of humanity, who has no compassion for the calamities of others; since there is no affliction which happens to any man, but either that, or some other as great, may fall upon himself. But those persons are generally soonest touched with this passion, who have met with misfortunes themselves. And by how much greater the distress is, or by how much the person appears less deserving it, the higher pity does it excite; for which reason, persons are generally most moved at the misfortunes of their relations and friends, or those of the best figure and character. The orator, therefore, in order to excite the greater pity, will endeavour to heighten the idea of the calamity, from the several circumstances both of the thing itself and the person who labours under it. A fine example of this may be seen in Cicero's defence of Muræna, *Cap.* 40, &c.

Indignation, as opposed to *pity*, is an uneasiness at the felicity of another who does not seem to deserve it. But this respects only external advantages, such as riches, honours, and the like; for virtues cannot be the object of this passion. Aristotle therefore says, "that pity and indignation are generally to be found in the same persons, and are both evidences of a good disposition." Now the orator excites this passion, by showing the person to be unworthy of that felicity which he enjoys. And as, in order to move compassion, it is sometimes of use to compare the former happy state of the person with his present calamity; so here, the greater indignation is raised, by comparing his former mean circumstances with his present advancement: as Cicero does in the case of Vatinius.

These are the passions with which an orator is principally concerned. In addressing to which, not only the greatest warmth and force of expression is often necessary; but he must likewise first endeavour to impress his own mind with the same passion he would excite in others.

A man may convince, and even persuade others to act, by mere reason and argument. But that degree of eloquence which gains the admiration of mankind, and properly denominates one an orator, is never found without warmth or passion. Passion, when in such a degree as to rouse and kindle the mind, without throwing it out of the possession of itself, is universally found to exalt all the human powers. It renders the mind infinitely more enlightened, more penetrating, more vigorous and masterly, than it is in its calm moments. A man, actuated by a strong passion, becomes much greater than he is at other times. He is conscious of more strength and force; he utters greater sentiments, conceives higher designs, and executes them with a boldness and a felicity of which on other occasions he could not think himself capable. But chiefly, with respect to persuasion, is the power of passion felt. Almost every man in passion is eloquent. Then he is at no loss for words and arguments. He transmits to others, by a sort of contagious sympathy, the warm sentiments which he feels; his looks and gestures are all persuasive; and nature here shows herself infinitely more powerful than art. This is the foundation of that just and noted rule, *Si vis me flere, dolendum est primum ipsi tibi.*

The warmth, however, which we express, must be suited to the occasion and the subject; for nothing can be more preposterous than an attempt to introduce great vehemence into a subject, which is either of slight importance, or which, by its nature, requires to be treated of calmly. A temperate tone of speech is that for which there is most frequent occasion; and he who is on every subject passionate and vehement, will be considered as a blusterer, and meet with little regard.

PART II. OF DISPOSITION.

AS *Invention* supplies the orator with necessary materials, so *Disposition* directs him how to place them in the most proper and suitable order. Disposition, therefore, considered as a part of oratory, naturally follows invention. And what is here chiefly intended by it is, the placing the several parts of a discourse in a just method and dependence upon one another.

Writers are not all agreed in determining the parts of an oration; though the difference is rather in the manner of considering them, than in the things themselves. But Cicero, whom we shall here follow, mentions six, namely, *Introduction*, *Narration*, *Proposition*, *Confirmation*, *Confutation*, and *Conclusion*.

Chap. I. *Of the Introduction.*

14 Introduction gains the hearts and attention of the audience, and gives a general notion of the subject.

The design of this is to prepare the minds of the hearers for a suitable reception of the remaining parts that are to follow. And for this end, three things are requisite; that the orator gain the *good opinion* of his hearers, that he secure their *attention*, and give them some *general notion* of his subject.

1. *Good opinion.* When the orator introduces his discourse with his own person, he will be careful to do it with modesty, and seem rather to extenuate his virtues and abilities, than to magnify them. And where the nature of the subject may seem to require it, he will endeavour to show, that some just and good reason induced him to engage in it. We have a very fine example of this in Cicero's oration for the poet Aulus Licinius Archias, which begins thus: "If I have any natural genius, which I am sensible is very small, or any ability in speaking, wherein I own I have been very conversant; or any skill acquired from the study and precepts of the best arts, to which my whole life has been devoted; this Aulus Licinius has in a particular manner, a right to demand of me the fruit of all these things. For as far back as I can remember, and call to mind what passed in my youth to the present time, he has been my chief adviser and encourager both to undertake and pursue this course of studies." When the orator sets out with the persons of those to whom the discourse is made, it is not unusual to commend them for their virtues, and those especially which have a more immediate relation to the present subject. Thus Cicero begins his oration of thanks for the pardon of Marcellus, with an encomium upon the mildness, clemency, and wisdom of Cæsar, to whom it was addressed.

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But sometimes the orator expresses his gratitude for past favours; as Cicero has done in his orations, both to the people and senate of Rome, after his return from banishment.—And at other times he declares his concern for them and their interest; in which manner Cicero begins his fourth oration against Catiline, which was made in the senate." "I perceive (says he) that all your countenances and eyes are turned on me; I perceive that you are solicitous, not only for your own danger, and that of the state, but for mine likewise, if that should be removed. Your affection for me is pleasant in misfortunes, and grateful in sorrow; but I adjure you to lay it aside, and, forgetting my safety, consider yourselves and your children." But in judicial cases, both the character of the person whose cause he espouses, and that of the adverse party likewise, furnish the orator with arguments for exciting the good will of his hearers: The former, by commemorating his virtues, dignity, or merits, and sometimes his misfortunes and calamities. So Cicero, in his defence of Flaccus, begins his oration in commending him on the account of his services done to the public, the dignity of his family, and his love to his country. And Demosthenes, in his oration against Midias, sets out with a recital of his vices, in order to recommend his own cause to the favourable opinion of the court.

2. *Attention.* On this head, Cicero says, "We shall be heard attentively on one of these three things; if we propose what is great, necessary, or for the interest of those to whom the discourse is addressed." So that, according to him, the topics of attention are much the same with those of good opinion, when taken from the subject. And indeed, people are naturally led to attend either to those things or persons of which they have entertained a favourable opinion. But in order to gain this point, the orator sometimes thinks it proper to request the attention of his audience. Thus Cicero, in his defence of Cluentius, after having shown the heinousness of the charge against him, concludes his introduction in the following manner, speaking to the judges; "Wherefore I entreat, that while I briefly and clearly reply to a charge of many years standing, you will, according to your usual custom, give me a kind and attentive hearing." And again, in his second Philippic, addressing himself to the senate: "But as I must say something for myself, and many things against Mark Antony; one of these I beg of you, that you will hear me kindly, while I speak for myself; and the other I will undertake for, that when I speak against him, you shall hear me with attention." But though the introduction be the most usual and proper place for gaining attention, yet the orator finds it convenient sometimes to quicken and excite his hearers in other parts of his discourse, when he observes they flag, or has something of moment to offer.

3. Some *general account* of the subject of the discourse. This is always necessary; which the two others are not. And therefore it must be left to the prudence of the orator when to use or omit them as he shall judge proper, from the nature of his discourse, the circumstance of his hearers, and how he stands with them. But some account of the subject is what cannot be neglected. For every one expects to be soon informed of the design of the speaker, and what he proposes to treat of. Nor when they are all made use of, is it necessary they should always stand in the order we have here placed them. Cicero sometimes enters immediately upon his subject, and introduces the other heads afterwards. As in his third oration against Catiline, made to the body of the Roman people, which begins thus: "You see that the state, all your lives, estates, fortunes, wives, and children, and this seat of the greatest empire, the most flourishing and beautiful city, having by the favour of heaven towards you, and my labours, counsels, and dangers, been this day rescued from fire and sword and the very jaws of destruction, are preserved and restored to you." And then he proceeds to recommend himself to their esteem and benevolence, from the consideration of these benefits.

25
Introduction is not confined to these heads, but can admit of other matter, if furnished by the circumstances of the case.

These are the heads which commonly furnish matter for this part of a discourse. But orators often take occasion from the time, place, largeness of the assembly, or some other proper circumstance, to compliment their hearers, recommend themselves, or introduce the subject upon which they are about to treat. Instances of each of these may be met with in several of Cicero's orations. And sometimes they set out with some comparison, similitude, or other ornament, which they accommodate to the occasion of their discourse. Thus Isocrates enters upon his celebrated panegyric in praise of his countrymen the Athenians with the following comparison: "I have often wondered what could be their design who brought together these assemblies, and instituted the gymnastic sports, to propose so great rewards for bodily strength; and to vouchsafe no honour to those who applied their private labours to serve the public, and so cultivated their minds as to be serviceable to others, to whom they ought to have shown greater regard. For although the strength of a champion was doubled, no benefit would from thence accrue to others; but all enjoy the prudence of one man, who will hearken to his advice." In some cases, orators have recourse to a more covert and artful way of opening their subject, endeavour to remove jealousies, apologize for what they are about to say, and seem to refer it to the candour of the hearers to judge of it as they please. Cicero appears to have been a perfect master of this art, and used it with great success. Thus in his seventh Philippic, where he seems to express the greatest concern, lest what he was about to say should give any offence to the senate to whom he was speaking: "I (says he) who always declared for peace, and to whom peace among ourselves, as it is wished for by all good men, was in a particular manner desirable; who have employed all my industry in the forum, in the senate, and in the defence of my friends, whence I have arrived to the highest honours, a moderate fortune, and what reputation I enjoy; I therefore, who owe what I am to peace, and without it could not have been the person I am, be that what it will, for I would arrogate nothing to myself; I speak with concern and fear, how you will receive what I am going to say; but I beg and entreat you, from the great regard I have always expressed for the support and advancement of your honour, that if any thing said by me should at first appear harsh or unfit to be received, you will notwithstanding please to hear it without offence, and not reject it till I have explained myself: I then, for I must repeat it again, who have always approved of peace, and promoted it, am against a peace with Mark Antony."

Antony." This is called *insinuation;* and may be necessary, where a cause is in itself doubtful, or may be thought so from the received notions of the hearers, or the impressions already made upon them by the contrary side. An honest man would not knowingly engage in a bad cause; and yet, through prevailing prejudice, that may be so esteemed which is not so in itself. In these cases, therefore, great caution and prudence are necessary to give such a turn to things, and place them in that view as may be least liable to offence. And because it sometimes happens that the hearers are not so much displeased at the object as the person, Quintilian's rule seems very proper, when he says, "If the subject displease, the character of the person should support it; and when the person gives offence, he should be helped by the cause."

Chap. II. *Of Narration.*

26 Narration brings forward all those circumstances of a case, &c. in their proper and natural order, which are calculated to set it in a just or a strong light.

The orator having prepared his hearers to receive his discourses with candour and attention, and acquainted them with his general design in the introduction, before he proceeds directly to his subject, often finds it necessary to give some account of what preceded, accompanied, or followed upon it. And this he does in order to enlarge the view of the particular point in dispute, and place it in a clearer light. This is called *narration;* which is a recital of something done, in the order and manner in which it was done. Hence it is easy to perceive what those things are which properly enter into a narration. And such are the cause, manner, time, place, and consequences of an action; with the temper, fortune, views, ability, associates, and other circumstances of those concerned in it. Not that each of these particulars is necessary in every narration: but so many of them at least as are requisite to set the matter in a just light, and make it appear credible. Besides, in relating a fact, the orator does not content himself with such an account of it as is barely sufficient to render what he says intelligible to his hearers; but describes it in so strong and lively a manner, as may give the greatest evidence to his relation, and make the deepest impression upon their minds. And if any part of it appear at present less probable, he promises to clear up and remove any remaining doubts in the progress of his discourse. For the foundation of his reasoning afterwards is laid in the narration, from whence he takes his arguments for the confirmation. And therefore it is a matter of no small importance that this part be well managed, since the success of the whole discourse so much depends upon it. See Narration.

There are four properties required in a good narration; that it be short, clear, probable, and pleasant.

1. The *brevity* of a narration is not to be judged of barely from its length: for that may be too long, which contains but a little; and that too short, which comprehends a great deal. Wherefore this depends upon the nature of the subject, since some things require more words to give a just representation of them, and others fewer. That may properly, therefore, be called a *short narration*, which contains nothing that could well have been omitted, nor omits any thing which was necessary to be said. Now, in order to avoid both these extremes, care should be taken not to go farther back in the account of things, nor to trace them down lower, than the subject requires; to say that only in the general, which does not need a more particular explication; not to assign the causes of things, when it is enough to show they were done; and to omit such things as are sufficiently understood, from what either proceeded, or was consequent upon them. But the orator should be careful, lest, while he endeavours to avoid prolixity, he run into obscurity. Horace was very sensible of this danger, when he said,

By striving to be short, I grow obscure.

2. *Perspicuity.* This may justly be esteemed the chief excellency of language. For as the design of speech is to communicate our thoughts to others, that must be its greatest excellence which contributes most to this end; and that, doubtless, is perspicuity. As perspicuity therefore is requisite in all discourse, so it is particularly serviceable in a narration, which contains the substance of all that is to be said afterwards. Wherefore, if this be not sufficiently understood, much less can those things which receive their light from it. Now the following things render a narration clear and plain: Proper and significant words, whose meaning is well known and determined; short sentences, though full and explicit, whose parts are not perplexed, but placed in their just order; proper particles to join the sentences, and show their connexion and dependence on each other; a due regard to the order of time, and other circumstances necessary to be expressed; and, lastly, suitable transitions.

3. *Probability.* Things appear probable when the causes assigned for them appear natural; the manner in which they are described is easy to be conceived; the consequences are such as might be expected; the characters of the persons are justly represented; and the whole account is well attested, consistent with itself, and agreeable to the general opinion. Simplicity likewise in the manner of relating a fact, as well as in the style, without any reserve or appearance of art, contributes very much to its credibility. For truth loves to appear naked and open, stript of all colouring or disguise. The conspiracy of Catiline was so daring and extravagant, that no one but such a desperado could ever have undertaken it with any hopes of success. However, Cicero's account of it to the senate was so full and exact, and so well suited to the character of the person, that it presently gained credit. And therefore, when upon the conclusion of Cicero's speech, Catiline, who was present, immediately stood up, and desired they would not entertain such hard thoughts of him, but consider how much his family had always been attached to the public interest, and the great services they had done the state; their resentment rose so high, that he could not be heard: upon which he immediately left the city, and went to his associates.

4. The last thing required in a narration is, that it be *pleasant* and *entertaining*. And this is more difficult, because it does not admit of that accurate composition and pompous dress which delight the ear, and recommend some other parts of a discourse. For it certainly requires no small skill in the speaker, while he endeavours to express every thing in the most natural, plain, and easy manner, not to grow flat and tiresome.

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for Quintilian's remark is very just, that "the most experienced orators find nothing in eloquence more difficult, than what all who hear it fancy they could have said themselves." And the reason of this seems very obvious. For as all art is an imitation of nature, the nearer it resembles that, the more perfect it is in its kind. Hence unexperienced persons often imagine that to be easiest which suits best with those natural ideas to which they have been accustomed; till, upon trial, they are convinced of their mistake. Wherefore, to render this part of a discourse pleasant and agreeable, recourse must be had to variety both in the choice of words and turns of the expression. And therefore questions, admirations, interlocutions, imagery, and other familiar figures, help very much to diversify and enliven a narration, and prevent it from becoming dull and tedious, especially when it is carried on to any considerable length.

27
The uses of narration.

Having given a brief account of the nature and properties of a narration, we shall now proceed to consider the uses of it.

Laudatory orations are usually as it were a sort of continued narration, set off and adorned with florid language and fine images proper to grace the subject, which is naturally so well fitted to afford pleasure and entertainment. Wherefore a separate narration is more suited to *deliberative* and *judicial* discourses. In Cicero's oration for the Manilian law (which is of the former kind), the design of the narration is to show the Roman people the necessity of giving Pompey the command of the army against King Mithridates, by representing the nature of that war, which is done in the following manner: "A great and dangerous war (says he) threatens your revenues and allies from two very powerful kings, Mithridates and Tigranes; one of whom not being pursued after his defeat, and the other provoked, they think they have an opportunity to seize Asia. Letters are daily brought from those parts to worthy gentlemen of the equestrian order, who have large concerns there in farming your revenues: they acquaint me, as friends, with the state of the public affairs, and danger of their own; that many villages in Bithynia, which is now your province, are burnt down; that the kingdom of Ariobarzanes, which borders upon your revenues, is entirely in the enemy's power; that Lucullus, after several great victories, is withdrawn from the war; that he who succeeds him is not able to manage it; that all the allies and Roman citizens wish and desire the command of that war may be given to one particular person; and that he alone, and no other, is dreaded by the enemies. You see the state of the case; now consider what ought to be done." Here is an unhappy scene of affairs, which seemed to call for immediate redress. The causes and reasons of it are assigned in a very probable manner, and the account well attested by persons of character and figure. And what the consequences would be, if not timely prevented, no one could well be ignorant. The only probable remedy suggested in general is, the committing that affair to one certain person, which he afterwards shows at large could be no other than Pompey. But in Cicero's defence of Milo (which is of the *judicial* kind), the design of the narration, which is greatly commended by Quintilian, is to prove that, in the combat between Clodius and Milo, the former was the aggressor. And in order to make this appear, he gives a summary account of the conduct of Clodius the preceding year; and from the course of his actions and behaviour, shows the inveterate hatred he bore to Milo, who obstructed him in his wicked designs. For which cause he had often threatened to kill him, and given out that he should not live beyond such a time; and accordingly he went from Rome without any other apparent reason, but that he might have an opportunity to attack him in a convenient place near his own house, by which he knew Milo was then obliged to pass. Milo was in the senate that day, where he staid till they broke up, then went home, and afterwards set forward on his journey. When he came to the place in which he was to be assaulted, Clodius appeared every way prepared for such a design, being on horseback, and attended with a company of desperate ruffians ready to execute his commands; whereas Milo was with his wife in a chariot, wrapped up in his cloak, and attended with servants of both sexes. These were all circumstances which preceded the fact. And as to the action itself, with the event of it, the attack, as Cicero says, was begun by the attendants of Clodius from a higher ground, who killed Milo's coachman; upon which Milo, throwing off his cloak, leaped out, and made a brave defence against Clodius's men, who were got about the chariot. But Clodius, in the heat of the skirmish, giving out that Milo was killed, was himself slain by the servants of Milo, to avenge, as they thought, the death of their master. Here seems to be all the requisites proper to make this account credible. Clodius's open and avowed hatred of Milo, which proceeded so far as to threaten his life; the time of his leaving Rome; the convenience of the place; his habit and company so different from those of Milo; joined with his known character of a most profligate and audacious wretch, could not but render it very probable that he had formed that design to kill Milo. And which of them began the attack might very reasonably be credited from the advanced ground on which Clodius and his men were placed; the death of Milo's coachman at the beginning of the combat; the skirmish afterwards at the chariot; and the reason of Clodius's own death at last, which does not appear to have been intended, till he had given out that Milo was killed.

But a distinct and separate narration is not always necessary in any kind of discourse. For if the matter be well known before, a set and formal narrative will be tedious to the hearers. Or if one party has done it already, it is needless for the other to repeat it. But there are three occasions especially, in which it may seem very requisite: when it will bring light to the subject; when different accounts have already been given out concerning it; or when it has been misrepresented by the adverse party. If the point in controversy be of a dubious nature, or not sufficiently known to the hearers, a distinct account of the matter, with the particular circumstances attending it, must be very serviceable, in order to let them into a true state of the case, and enable them to judge of it with greater certainty.

Moreover, where the opposite party has set the matter in a false light by some artful and invidious turn, or loaded it with any odious circumstances, it seems no less necessary that endeavours should be used to remove any ill impressions, which otherwise might remain upon the minds

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minds of the hearers, by a different and more favourable representation. And if any thing can be fixed upon to make the contrary account appear absurd or incredible, it ought particularly to be remarked. Thus Cicero, in his defence of Sextus Roscius, shows that he was many miles distant from Rome at the time he was charged with having killed his father there. "Now (says he), while Sextus Roscius, was at Ameria, and this Titus Roscius [*his accuser*] at Rome, Sextus Roscius [*the father*] was killed at the baths on Mount Palatine, returning from supper. From whence I hope there can be no doubt who ought to be suspected of the murder. And, were not the thing plain of itself, there is this farther suspicion to fix it upon the prosecutor; that, after the fact was committed, one Manlius Glaucia, an obscure fellow, the freedman, client, and familiar, of this Titus Roscius, first carried the account of it to Ameria, not to the son of the deceased, but to the house of Titus Capito his enemy;" with more to the same purpose. But what we bring it for is, to show the use which Cicero makes of this narration for retorting the crime upon the prosecutors.

But the orator should be very careful, in conducting this part, to avoid every thing which may prejudice the cause he espouses. Falsehood, and a misrepresentation of facts, are not to be justified; but no one is obliged to say those things which may hurt himself. We shall just mention one instance of this from Cicero, where he has shown great skill in this respect, in pleading before Cæsar for the pardon of Ligarius, who had joined with Pompey in the civil war. For Ligarius, having been represented by the adverse party as an enemy to Cæsar, and so esteemed by Cæsar himself; Cicero very artfully endeavours in his narration to take off the force of this charge, by showing, that, when the war first broke out, he refused to engage in it; which he would not have done, had he borne any personal hatred to Cæsar. "Quintus Ligarius (says he), before there was any suspicion of a war, went into Africa as a legate to the proconsul Caius Confidius; in which he so approved himself, both to the Roman citizens and allies, that, when Confidius left the province, the inhabitants would not be satisfied he should leave the government in the hands of any other person. Therefore Quintus Ligarius having excused himself in vain for some time, accepted of the government against his will; which he so managed during the peace, that both the citizens and allies were greatly pleased with his integrity and justice. The war broke out on a sudden, which those in Africa did not hear of till it was begun: but upon the news of it, partly through inconsiderate haste, and partly from blind fear, they looked out for a leader, first for their own safety, and then as they were affected; when Ligarius, thinking of home, and desirous to return to his friends, would not be prevailed on to engage in any affairs. In the mean time, Publius Accius Varus, the prætor, who was formerly governor of Africa, coming to Utica, recourse was immediately had to him, who very eagerly took upon himself the government; if that can be called a *government*, which was conferred on a private man by the clamour of the ignorant multitude, without any public authority. Ligarius, therefore, who endeavoured to avoid every thing of that kind, ceased to act soon after the arrival of Varus." Here Cicero ends his narrative. For though Ligarius afterwards joined with Pompey's party, yet to have mentioned that, which was nothing more than what many others had done, whom Cæsar had already pardoned, could have served only to increase his displeasure against him. And therefore he doubtless showed great skill in so managing his account, as to take off the main force of the accusation, and by that means make way for his pardon, which he accordingly obtained.

Chap. III. *Of the Proposition.*

28 The proposition is a distinct and express manner of laying down the subject on which an orator means to treat.

In every just and regular discourse, the speaker's intention is to prove or illustrate something. And when he lays down the subject upon which he designs to treat, in a distinct and express manner, this is called the *proposition*.

Orators use several ways in laying down the subject of their discourses. Sometimes they do it in one general proposition. We have an instance of this in Cicero's speech to the senate, the day after Cæsar was killed (as it is given us by Dion Cassius), in which his design was to persuade them to peace and unanimity. "This (says he) being the state of our affairs, I think it necessary that we lay aside all the discord and enmity which have been among us, and return again to our former peace and agreement." And then he proceeds to offer his reasons for this advice.

At other times, to give a clearer and more distinct view of their discourse, they subjoin to the proposition the general heads of argument by which they endeavour to support it. This method Cicero uses in his seventh Philippic, where he says, "I who have always commended and advised to peace, am against a peace with Mark Antony. But why am I averse to peace? Because it is base, because it is dangerous, and because it is impracticable. And I beseech you to hear me with your usual candour, while I make out these three things."

29 When the subject refers to several different things, and requires to be laid down in distinct propositions, it is called a partition.

But when the subject relates to several different things, which require each of them to be separately laid down in distinct propositions, it is called a *partition*; though some have made two kinds of *partition*, one of which they call *separation*, and the other *enumeration*. By the former of these, the orator shows in what he agrees with his adversary, and wherein he differs from him. So, in the case formerly mentioned, of a person accused of sacrilege for stealing private money out of a temple, he who pleads for the defendant says, "He owns the fact; but it being private money, the point in question is, Whether this be sacrilege?" And in the cause of Milo, Cicero, speaking of Clodius, says, "The point which now comes before the court, is not, Whether he was killed or not; that we confess; but, Whether justly or unjustly." Now in reality here is no partition, since the former branch of the proposition is what is agreed upon, and given up; and consequently it is only the latter that remains to be disputed. It is called *enumeration*, when the orator acquaints his hearers with the several parts of his discourse upon which he designs to treat. And this alone, properly speaking, is a *partition*. Thus Cicero states his plea in his defence of Muræna: "I perceive the accusation consists of three parts: the first respects the conduct of his life; the second his dignity; and the third contains a charge of bribery."

There are three things requisite in a good partition;

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tion; that it be *short*, *complete*, and consist but of a *few members*

A partition is said to be *short*, when each proposition contains in it nothing more than what is necessary. So that the brevity here required is different from that of a narration; for that consists chiefly in things, this in words. And, as Quintilian justly observes, brevity seems very proper here, where the orator does not show what he is then speaking of, but what he designs to discourse upon.

Again, It ought to be *complete* and perfect. And for this end, care must be taken to omit no necessary part in the enumeration.

But however, there should be as *few heads* as is consistent with the nature of the subject. The ancient rhetoricians prescribe three or four at the most. And we do not remember that Cicero ever exceeds that number. But it is certain, the fewer they are, the better, provided nothing necessary be omitted. For too large a number is both difficult of retention, and apt to introduce that confusion which partition is designed to prevent.

Hitherto we have been speaking only of those heads into which the subject or general argument of the discourse is at first divided. For it is sometimes convenient to divide these again, or at least some of them, into several parts or members. And when this happens, it is best done, as the speaker comes to each of them in the order at first laid down; by which means the memory of the hearers will be less burdened than by a multitude of particulars at one and the same time. Thus Cicero, in his oration for the Manilian law, comprises what he designs to say under three general heads. "First (says he) I shall speak of the nature of the war, then of its greatness, and lastly about the choice of a general." And when he comes to the first of these, he divides it again into four branches; and shows, "how much the glory of the Romans, and safety of their allies, their greatest revenues, and the fortunes of many of their citizens, were all concerned in that war." The second head, in which he considers the greatness of the war, has no division. But when he comes to the third head, concerning the choice of a general, he divides that likewise into four parts; and shows, that so many virtues are necessary in a consummate general, such a one as was proper to have the management of that war, namely, *skill in military affairs*, *courage*, *authority*, and *success*: all which he attributes to Pompey. And this is the scheme of that celebrated oration.

This subdividing, however, should never have place but when it is absolutely necessary. To split a subject into a great many minute parts, by divisions and subdivisions without end, has always a bad effect in speaking. It may be proper in a logical treatise; but it makes an oration appear hard and dry, and unnecessarily fatigues the memory. In a sermon, there may be from three to five or six heads, including subdivisions; seldom should there be more.

30 Negative and positive divisions of a subject.

Further, Some divide their subject into two parts, and propose to treat upon it *negatively* and *positively*; by showing first what it is not, and then what it is. But while they are employed to prove what it is not, they are not properly treating upon that, but something else; which seems as irregular as it is unnecessary. For he who proves what a thing is, does at the same time show what it is not. However, in fact, there is a sort of division by affirmation and negation, which may sometimes be conveniently used. As if a person, charged with killing another, should thus state his defence: *I had done right if I had killed him, but I did not kill him.* Here indeed, if the latter can be plainly made to appear, it may seem needless to insist upon the form. But if that cannot be so fully proved, but there may be room left for suspicion, it may be proper to make use of both: for all persons do not see things in the same light, and he who believes the fact, may likewise think it just; while he who thinks it unjust, may not believe it, but rather suppose, had it really been committed by the party, he would not have denied it, since he looked upon it as defensible. And this method of proceeding, Quintilian compares to a custom often used in traffic, when persons make a large demand at first, in order to gain a reasonable price. Cicero uses this way of reasoning in his defence of Milo; but in the contrary order; that is, he first answers the charge; and then justifies the fact, upon the supposition that the charge was true. For he proves, first, that Clodius was the aggressor; and not Milo, as the contrary party had asserted: and then, to give the greater advantage to his cause, he proceeds to show, that if Milo had been the aggressor, it would however have been a glorious action to take off such an abandoned wretch, who was not only a common enemy to mankind, but had likewise often threatened his life.

A good and just partition is attended with considerable advantages. For it gives both light and ornament to a discourse. And it is also a great relief to the hearers, who, by means of these stops and rests, are much better enabled to keep pace with the speaker without confusion, and by casting their thoughts either way, from what has been said, both know and are prepared for what is to follow. And as persons, in travelling a road with which they are acquainted, go on with greater pleasure and less fatigue, because they know how far it is to their journey's end; so to be apprised of the speaker's design, and the several parts of his discourse which he proposes to treat on, contributes very much to relieve the hearer, and keep up his attention. This must appear very evident to all who consider how difficult it is to attend long and closely to one thing, especially when we do not know how long it may be before we are like to be released. Whereas, when we are beforehand acquainted with the scheme, and the speaker proceeds regularly from one thing to another, opportunity is given to ease the mind, by relaxing the attention, and recalling it again when necessary. In a sermon, or in a pleading at the bar, few things are of greater consequence than a proper or happy division. It should be studied with much accuracy and care; for if one take a wrong method at first setting out, it will lead him astray in all that follows. It will render the whole discourse either perplexed or languid; and though the hearers may not be able to tell where the fault or disorder lies, they will be sensible there is a disorder somewhere, and find themselves little affected by what is spoken. The French writers of sermons study neatness and elegance in the division of their subjects much more than the English do; whose distributions, though sensible and just, yet are often inartificial and verbose.

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Chap. IV. *Of Confirmation.*

31 Confirmation is used for the arguments brought in defence of a subject.

The orator having acquainted his hearers, in the proposition, with the subject on which he designs to discourse, usually proceeds either to prove or illustrate what he has there laid down. For some discourses require nothing more than an enlargement or illustration, to set them in a proper light, and recommend them to the hearers; for which reason, likewise, they have often no distinct proposition. But where arguments are brought in defence of the subject, this is properly *confirmation*. For as Cicero defines it, "confirmation is that which gives proof, authority, and support to a cause, by reasoning." And for this end, if any thing in the proposition seems obscure, or liable to be misunderstood, the orator first takes cares to explain it, and then goes on to offer such arguments for the proof of it, and represent them in such a light, as may be most proper to gain the assent of his hearers.

But here it is proper to observe, that there are different ways of reasoning suited to different arts. The mathematician treats his subject after another manner than the logician, and the orator in a method different from them both. Two methods of reasoning are employed by orators, the *synthetic and analytic*.

32 Synthetic reasoning may always be resolved into a syllogism or series of syllogisms.

I. Every piece of synthetic reasoning may be resolved into a syllogism or series of syllogisms, (see Logic). Thus we may reduce Cicero's argument, by which he endeavours to prove that Clodius assaulted Milo, and not Milo Clodius, to a syllogism in this manner:

He was the aggressor, whose advantage it was to kill the other.
But it was the advantage of Clodius to kill Milo, and not Milo to kill him.
Therefore Clodius was the aggressor, or he assaulted Milo.

The thing to be proved was, that Clodius assaulted Milo, which therefore comes in the conclusion: and the argument, by which it is proved, is taken from the head of profit or advantage. Thus the logician would treat this argument; and if either of the premises were questioned, he would support it with another syllogism. But this short and dry way of reasoning does not at all suit the orator: who not only for variety changes the order of the parts, beginning sometimes with the minor, and at other times with the conclusion, and ending with the major; but likewise clothes each part with such ornaments of expression as are proper to enliven the subject, and render it more agreeable and entertaining. And he frequently subjoins either to the major proposition, or minor, and sometimes to both, one or more arguments to support them; and perhaps others to confirm or illustrate them as he thinks it requisite. Therefore, as a logical syllogism consists of three parts or propositions, a rhetorical syllogism frequently contains four, and many times five parts. And Cicero reckons this last the most complete. But all that is said in confirmation of either of the premises is accounted but as one part. This will appear more evident by examples: By a short syllogism Cicero thus proves, that the Carthaginians were not to be trusted: "Those who have often deceived us, by violating their engagements, ought not to be trusted. For if we receive any damage by their treachery, we can blame nobody but ourselves. But the Carthaginians have often so deceived us. Therefore it is madness to trust them." Here the major proposition is supported by a reason. The minor needed none; because the treachery of the Carthaginians was well known. So that the syllogism consists of four parts. But by a syllogism of five parts he proves somewhat more largely and elegantly, that the world is under the direction of a wise governor. The major is this: "Those things are better governed which are under the direction of wisdom, than those which are not." This he proves by several instances: "A house managed with prudence has every thing in better order, and more convenient than that which is under no regulation. An army commanded by a wise and skilful general is in all respects better governed than one which has a fool and a madman at the head of it. And the like is to be said of a ship, which performs her course best under the direction of a skilful pilot." Then he proceeds to the minor thus: "But nothing is better governed than the universe." Which he proves in this manner: "The rising and setting of the heavenly bodies keep a certain determined order; and the several seasons of the year do not only necessarily return in the same manner, but are suited to the advantage of the whole; nor did the vicissitudes of night and day ever yet become prejudicial, by altering their course." From all which he concludes, "that the world must be under the direction of a wise governor." In both these examples, the regular order of the parts is observed. We shall therefore produce another, in which the order is directly contrary; for beginning with the conclusion, he proceeds next to the minor proposition, and so ends with the major. In his defence of Cœlius, his design is to prove that Cœlius had not led a loose and vicious life, with which his enemies had charged him. And this he does, by showing he had closely followed his studies, and was a good orator. This may probably at first sight appear but a weak argument; though to him who considers what Cicero every where declares necessary to gain that character, it may perhaps be thought otherwise. The sense of what he says here may be reduced to this syllogism.

Those who have pursued the study of oratory, so as to excel in it, cannot have led a loose and vicious life.
But Cœlius has done this.
Therefore his enemies charge him wrongfully.

But let us hear Cicero himself. He begins with the conclusion, thus: "Cœlius is not chargeable with profuseness, extravagancy, contracting of debts, or intemperance, a vice which age is so far from abating, that it rather increases it. Nay, he never engaged in amours, and those pleasures of youth, as they are called, which are soon thrown off, as reason prevails." Then he proceeds to the minor, and shows from the effects, that Cœlius had closely applied himself to the best arts, by which he means those necessary for an orator: "You have now heard him make his own defence, and you formerly heard him engaged in a prosecution (I speak this to vindicate, not to applaud him), you could not but perceive his manner of speaking, his ability, his good sense, and command of language. Nor did he only discover a good genius,

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genius, which will oftentimes do much of itself when it is not improved by industry; but what he said (if my affection for him did not bias my judgment) appeared to be the effect of learning, application, and study." And then he comes to the major: "But be assured, that those vices charged upon Cœlius, and the studies upon which I am now discoursing, cannot meet in the same person. For it is not possible that a mind, disturbed by such irregular passions, should be able to go through what we orators do, I do not mean only in speaking, but even in thinking." And this he proves by an argument taken from the scarcity of good orators. "Can any other reason be assigned, why so few, both now, and at all times, have engaged in this province, when the rewards of eloquence are so magnificent, and it is attended with so great delight, applause, glory, and honour? All pleasures must be neglected; diversions, recreations, and entertainments omitted; and even the conversation of all our friends must in a manner be laid aside. This it is which deters persons from the labour and study of oratory; not their want of genius or education."

33
Orators do not often use complete syllogisms, but most commonly imperfect ones, called *enthymems*.

2. By *Enthymem*. But orators do not often use complete syllogisms, but most commonly enthymems. An *enthymem*, as is shown elsewhere, is an imperfect syllogism, consisting of two parts; the conclusion, and one of the premises. And in this kind of syllogism, that proposition is omitted, whether it be the major or minor, which is sufficiently manifest of itself, and may easily be supplied by the hearers. But the proposition that is expressed is usually called the *antecedent*, and the conclusion the *consequent*. So if the major of that syllogism be omitted, by which Cicero endeavours to prove that Clodius assaulted Milo, it will make this enthymem:

> *The death of Milo would have been an advantage to Clodius.*
> *Therefore Clodius was the aggressor; or, therefore, he assaulted Milo.*

In like manner, that other syllogism above mentioned, by which he shows that the Carthaginians ought not to be trusted, by omitting the minor, may be reduced to the following enthymem:

> *Those who have often broke their faith ought not to be trusted.*
> *For which reason the Carthaginians ought not to be trusted.*

Every one would readily supply the minor, since the perfidiousness of the Carthaginians was known to a proverb. But it is reckoned a beauty in enthymems, when they consist of contrary parts, because the turn of them is most acute and pungent. Such is that of Micipsa in Sallust: "What stranger will be faithful to you who are an enemy to your friends?" And so likewise that of Cicero for Milo, speaking of Clodius: "You sit as avengers of his death; whose life you would not restore, did you think it in your power." Orators manage enthymems in the same manner they do syllogisms; that is, they invert the order of the parts, and confirm the proposition by one or more reasons; and therefore a rhetorical enthymem frequently consists of three parts, as a syllogism does of five. Though, strictly speaking, a syllogism can consist of no more than three parts, and an enthymem but of two: and the arguments brought to support either of the propositions constitute so many new enthymems, of which the part they are designed to prove is the conclusion. To illustrate this by an example:

> *An honest man thinks himself under the highest obligation to his country.*
> *Therefore he should shun no danger to serve it.*

In this *enthymem* the major is wanting, which would run thus: "He who is under the highest obligations to another, should shun no danger in order to serve him." This last proposition is founded upon the common principle of gratitude; which requires that, to the utmost of our power, a return should be made in proportion to the kindness received. And this being a maxim generally allowed, it is omitted by the orator. But now this enthymem, consisting of the minor and conclusion, might be managed in some such manner as this, beginning with the conclusion: "An honest man ought to shun no danger, but readily expose his life for the safety and preservation of his country." Then the reason of this conduct might be added, which is the antecedent of the enthymem, or minor of the syllogism: "For he is sensible that his obligations to his country are so many, and so great, that he can never fully requite them." And this again might be confirmed by an enumeration of particulars: "He looks upon himself as indebted to his country for every thing he enjoys; for his friends, relations, all the pleasures of life, and even for life itself. Now the orator calls this *one enthymem*, though in reality there are two: For the second reason, or argument, added to the first, becomes the antecedent of a new enthymem, of which the first reason is the consequent. And if these two enthymems were expressed separately in the natural order of the parts, the former would stand thus: "An honest man thinks himself under the highest obligations to his country; therefore he ought to shun no danger for its preservation." The latter thus: "An honest man esteems himself indebted to his country for every thing he enjoys; therefore he thinks he is under the highest obligations to it." The same thing might be proved in the like way of reasoning, by arguments of a different kind. From comparison, thus: "As it would be thought base and ungrateful in a son not to hazard himself for the preservation of his father; an honest man must certainly esteem it so when his country is in danger." Or from an example, in this manner: An honest man in like circumstances would propose to himself the example of Decius, who freely gave up his life for the service of his country. He gave up his life indeed, but did not lose it; for he cannot be said to have lost his life, who lives in immortal honour." Orators frequently intermix such arguments to adorn and illustrate their subject with others taken from the nature and circumstances of things. And now, if we consider a little this method of reasoning, we shall find it the most plain and easy imaginable. For when any proposition is laid down, and one or more reasons subjoined to prove it, each reason joined with the proposition makes a distinct enthymem, of which the proposition is the conclusion. Thus Cicero, in his seventh Philippic, lays down this as the foundation of his discourse, "That he is against a peace with Mark Antony;" for which he gives three reasons: "Because it is base, because it is dangerous, and

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and because it is impracticable. These severally joined with the proposition, form three enthymems; and upon each of these he discourses separately, which make up that oration. And this method is what persons for the most part naturally fall into, who know nothing of the terms *syllogism* or *enthymem*. They advance something, and think of a reason to prove it, and another perhaps to support that; and, so far as their invention will assist them, or they are masters of language, they endeavour to set what they say in the plainest light, give it the best dress, embellish it with proper figures and different turns of expression; and, as they think convenient, illustrate it with similitudes, comparisons, and the like ornaments, to render it most agreeable, till they think what they have advanced sufficiently proved. As this method of arguing therefore is the most plain, easy, and natural; so it is what is most commonly used in oratory. Whereas a strict syllogistical way of discoursing is dry and jejune, cramps the mind, and does not admit of those embellishments of language which are a great advantage to the orator; for which reason he seldom uses complete syllogisms; and when he does, it is with great latitude. In every discourse care should be taken not to blend arguments confusedly together that are of a separate nature. "All arguments (says the elegant Dr Blair,) are directed to prove one or other of these three things; that something is true; that it is morally right or fit; or that it is profitable and good. These make the three great subjects of discussion among mankind; truth, duty, and interest. But the arguments directed towards any one of them are generally distinct; and he who blends them all under one topic, which he calls his argument, as, in sermons especially, is too often done, will render his reasoning indistinct and inelegant. Suppose, for instance, that I am recommending to an audience benevolence, or the love of our neighbour; and that I take my first argument from the inward satisfaction which a benevolent temper affords; my second, from the obligation which the example of Christ lays upon us to this duty; and third, from its tendency to procure us the good will of all around us; my arguments are good, but I have arranged them wrong: for my first and third arguments are taken from considerations of interest, internal peace, and external advantages; and between these, I have introduced one, which rests wholly upon duty. I should have kept those classes of arguments, which are addressed to different principles in human nature, separate and distinct."

34
The analytic method of reasoning nearly the same with the Socratic.

II. The other method of reasoning is the analytic, in which the orator conceals his intention concerning the point he is to prove, till he has gradually brought his hearers to the designed conclusion. They are led on, step by step, from one known truth to another, till the conclusion be stolen from them, as the natural consequence of a chain of propositions. As, for instance, when one intending to prove the being of a God, sets out with observing that every thing which we see in the world has had a beginning; that whatever has had a beginning, must have had a prior cause; that in human productions, art shown in the effect, necessarily infers design in the cause; and proceeds leading you on from one cause to another, till you arrive at one supreme first cause, from whom is derived all the order and design visible in his works. This is much the same with the Socratic method, by which that philosopher silenced the sophists of his age.

He proceeded by several questions, which being separately granted, the thing designed to be inferred was afterwards put, which, by reason of its similitude with several cases allowed before, could not be denied. But this is a captious way of reasoning; for while the respondent is not aware of what is designed to be inferred, he is easily induced to make those concessions, which otherwise he would not. Besides, it is not so well suited to continued discourses, as to those which are interlocutory; and therefore we meet with it oftenest in the Socratic dialogues both of Plato and Xenophon. However, it may be made use of in oratory by a figure called *subjection*, when the same person first puts the question, and then makes the answer. So in the famous cause of Epaminondas, general of the Thebans, who was accused for refusing to surrender his command to his successor appointed by the state, till after he had engaged the enemy, and given them a total defeat, Cicero thus represents his accuser pleading for the words of the law against Epaminondas, who alleged the intention of it in his defence: "Should Epaminondas add that exception to the law, which, he says, was the intention of the writer namely, *Except any one refuse to give up his command when it is for the interest of the public he should not;* would you admit of it? I believe not. Should you yourselves, which is a thing most remote from your justice and wisdom, in order to screen him, order this exception to be added to the law, without the command of the people; would the Thebans suffer it to be done? No, certainly. Can it be right then to come into that, as if it was written, which it would be a crime to write? I know it cannot be agreeable to your wisdom to think so."

Under the analytic method may be comprehended reasoning by *example*. Rhetoricians use this word in a different sense from the common acceptation. For that is usually called an *example*, which is brought either to prove or illustrate some general assertion: As if any one should say, that *human bodies may be brought to sustain the greatest labours by use and exercise;* and in order to prove this should relate what is said of Milo of Croton, that "by the constant practice of carrying a calf several furlongs every day, he would carry it as far after it had grown to its full size." But in oratory the word *example* is used for any kind of similitude; or, as Vossius defines it, "When one thing is inferred from another, by reason of the likeness which appears between them." Hence it is called an *imperfect induction*, which infers something from several others of a like nature, and has always the greatest force when the examples are taken from facts. Now facts may be compared with respect to some agreement or similitude between them, which in themselves are either equal or unequal. Of the former kind this is an instance: Cato acted as became a patriot and a lover of his country's liberty, in opposing the arms of Cæsar: and therefore so did Cicero." The reason of the inference is founded in the parity of the case, which equally concerned all good subjects of the Roman government at that time. For all were alike obliged to oppose a common enemy, who endeavoured to subvert the constitution, and subject them to his own arbitrary power. But though an example 35

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May comprehend reasoning by *example*.

ample consists in the comparison of two single facts, yet several persons may be concerned in each fact. Of this kind is that which follows: "As Pompey, Cæsar, and Crassus, acted illegally in the first triumvirate, by engrossing the sole power into their own hands, and by that means violating the public liberty; so likewise did Augustus, Mark Antony, and Lepidus, in the second triumvirate, by pursuing the same measures." But when Cicero defends Milo for killing Clodius, from the like instances of Ahala Servilius, Scipio Nasica, Lucius Opimius, and others; that is not an example, but an induction: because one thing is there inferred from its similitude to several others. But when a comparison is made between two facts that are unequal, the inference may be either from the greater to the less, or from the less to the greater. From the greater to the less in this manner: "Cæsar had no just pretensions to the Roman government, and therefore much less had Antony." The reason lies in the difference between the two persons. Cæsar had very much enlarged the bounds of the Roman empire by his conquests, and greatly obliged the populace by his generosity; but as he had always acted by an authority from the senate and people of Rome, these things gave him no claim to a power over them. Much less then had Antony any such pretence, who always acted under Cæsar, and had never performed any signal services himself. Cicero has described the difference between them in a very beautiful manner in his second Philippic, thus speaking to Antony: "Are you in any thing to be compared to him? He had a genius, sagacity, memory, learning, care, thought, diligence; he had performed great things in war, though detrimental to the state; he had for many years designed to get the government into his hands, and obtained his end by much labour and many dangers; he gained over the ignorant multitude by public shows, buildings, congiaries, and feasts; obliged his friends by rewards, and his enemies by a show of clemency. In a word, he subjected a free state to slavery, partly through fear, and partly compliance. I can liken you to him for ambition of power; but in other things you are in no respect to be compared with him." By a comparison from the less to the greater. Cicero thus argues against Catiline: "Did the brave Scipio, when a private man, kill Tiberius Gracchus, for attempting to weaken the state; and shall we consuls bear with Catiline endeavouring to destroy the world by fire and sword?" The circumstances of these two cases were very different; and the comparison runs between a private man and a consul instrusted with the highest authority; between a design only to raise a tumult, and a plot to destroy the government: whence the orator justly infers, that what was esteemed lawful in one case, was much more so in the other. The like way of reasoning is sometimes used from other similitudes, which may be taken from things of all kinds, whether animate or inanimate. Of the former sort is that of Cicero speaking of Muræna, when candidate for the consulship, after he had himself gone through that office: "If it is usual (says he) for such persons as are safely arrived in port, to give those who are going out the best account they can with relation to the weather, pirates, and coasts; because thus nature directs us to assist those who are entering upon the same dangers which we ourselves have escaped: how ought I, who now after a great storm am brought within a near prospect of land, to be affected towards him, who, I perceive, must be exposed to the greatest tempests of the state?" He alludes to the late disturbances and tumults occasioned by the conspiracy of Catiline, which had been so happily suppressed by him in the time of his consulate. Of the latter kind is that of Quintilian: "As the ground is made better and more fruitful by culture, so is the mind by instruction." There is both a beauty and justness in this simile.

But comparisons are sometimes made between facts and other things, in order to infer some difference or opposition between them. In comparing two facts, on account of some disagreement and unlikeness, the inference is made from the difference between one and the other in that particular respect only. As thus: "Though it was not esteemed cruelty in Brutus to put his two sons to death for endeavouring to betray their country; it might be so in Manlius who put his son to death, only for engaging the enemy without orders, though he gained the victory." The difference between the two facts lies in the different nature of the crime. The sons of Brutus entered into a conspiracy to betray their country; and though they miscarried in it, yet the intention and endeavours they used to accomplish it were criminal in the highest degree. But young Manlius could only be charged with rashness. His design was honourable, and intended for the interest of his country; only it was irregular, and might have proved of ill consequence to military discipline. Now in all such cases, the force of the argument is the stronger the greater the difference appears. But the same facts which differ in one respect may agree in many others; as in the example here mentioned. Brutus and Manlius were both magistrates as well as fathers; they both killed their sons, and that for a capital crime by the Roman law. In any of which respects they may be compared in a way of similitude: as, "If Brutus might lawfully put his son to death for a capital crime, so might Manlius." But now contrary facts do not only differ in some certain respect, but are wholly opposite to each other; so that what is affirmed of the one must be denied of the other; and if one be a virtue, the other is a vice. Thus Cicero compares the conduct of Marcellus and Verres in a way of opposition. "Marcellus (says he), who had engaged, if he took Syracuse, to erect two temples at Rome, would not beautify them with the spoils he had taken: Verres, who had made no vows to Honour and Virtue, but to Venus and Cupid, endeavoured to plunder the temple of Minerva. The former would not adorn the gods with the spoils of other deities: the latter carried the ornaments of Minerva, a virgin, into the house of a strumpet." If therefore the conduct of Marcellus was laudable and virtuous, that of Verres must bear the contrary character. But this way of reasoning has likewise place in other respects. Thus Cicero, in the quarrel between Cæsar and Pompey, advised to peace from the difference between a foreign and domestic war: "That the former might prove beneficial to the state; but in the latter, whichever side conquered, the public must suffer." And thus the ill effects of intemperance may be shown in a way of opposition: "That as temperance preserves the health of the body, keeps up the vigour of the mind, and prolongs life; so excess must necessarily have the contrary effects.

Thus we have given a brief account of the principal ways

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ways of reasoning commonly made use of by orators. As to the disposition of arguments, or the order of placing them, some advise to put the weaker, which cannot wholly be omitted, in the middle: and such as are stronger, partly in the beginning, to gain the esteem of the hearers, and render them more attentive; and partly at the end, because what is last heard is likely to be retained longest: But if there are but two arguments, to place the stronger first, and then the weaker; and after that to return again to the former, and insist principally upon that. But this must be left to the prudence of the speaker, and the nature of the subject. Though to begin with the strongest, and so gradually descend to the weakest, can never be proper, for the reason last mentioned. Nor ought arguments to be crowded too close upon one another; for that takes off from their force, as it breaks in upon the attention of the hearers, and does not leave them sufficient time duly to consider them. Nor indeed should more be used than are necessary; because the fewer they are, the more easily they are remembered. And the observation of a great master of eloquence upon this subject is certainly very just, that *arguments ought rather to be weighed than numbered.*

CHAP. V. *Of Confutation.*

36
Forms of confutation the same with those of confirmation, but more difficult.

THE forms of reasoning here are the same as have been already explained under *confirmation. Confutation* however, is often the more difficult task; because he who is to prove a thing comes usually prepared; but he who is to confute it is frequently left to a sudden answer. For which reason, in *judicial* cases, Quintilian says, "It is as much easier to accuse than defend, as it is to make a wound than to heal it." Therefore, not only a good judgment, but a readiness of thought also, seems necessary for this province. But, in all disputes, it is of the greatest consequence to observe where the stress of the controversy lies. For without attending to this, persons may cavil about different matters, without understanding each other, or deciding any thing. And in confutation, what the adversary has advanced ought carefully to be considered, and in what manner he has expressed himself. As to the things themselves, whether they immediately relate to the matter in dispute, or are foreign to it. Those things that are foreign to the subject may either be past over in silence, or in a very few words shown to be insignificant. And there ought likewise to be a distinction made between such things as relate to the subject, according to their importance. Those that appear to have no great weight should be slightly remarked. For to insist largely upon such matters is both tiresome to the hearers, and apt to bring the judgment of the speaker in question. And therefore things of that nature are generally better turned off with an air of neglect, a pungent question, or an agreeable jest, than confuted by a serious and laboured answer. But those things, which relate to the merits of the cause, may be confuted either by *contradicting* them, or by showing some *mistake* in the reasoning, or their *invalidity* when granted.

Things may be *contradicted* several ways. What is apparently false may be expressly *denied.* Thus Cicero in his defence of Cluentius. "When the accuser had said that the man fell down dead after he had drunk off his cup, denies that he died that day." And things which the adversary cannot prove, may likewise be denied. Of which we have also an instance in Cicero, who first upbraids Mark Antony as guilty of a breach not only of good breeding, but likewise of friendship, for reading publicly a private letter he had sent him. And then adds, "But what will you say now, if I should deny that ever I sent you that letter? How will you prove it? By the hand-writing? In which I confess you have a peculiar skill, and have found the benefit of it. But how can you make it out? For it is in my secretary's hand. I cannot but envy your master who had so great a reward for teaching you to understand just nothing. For what can be more unbecoming not only an orator, but even a man, than for any one to offer such things, which if the adversary denies he has nothing more to say?" It is a handsome way of contradicting a thing, by showing that the adversary himself maintained the contrary. So when Oppius was charged with defrauding the soldiers of their provision, Cicero refutes it, by proving, that the same persons charged Oppius with a design to corrupt the army by his liberality. An adversary is never more effectually silenced than when you can fasten contradictions upon him; for this is stabbing him with his own weapon. Sometimes a thing is not in express terms denied, but represented to be utterly incredible. And this method exposes the adversary more than a bare denial. So when some persons reproached Cicero with cowardice, and a shameful fear of death, he recites their reasons in such a manner, that any one would be inclined to think the charge entirely false. "Was it becoming me (says he) to expect death with that composedness of mind as some have imagined? Well, and did I then avoid it? Nay, was there any thing in the world that I could apprehend more desirable? Or, when I had done the greatest things in such a crowd of ill-minded persons about me, do you think banishment and death were not always in my view, and continually sounding in my ears as my certain fate, while I was so employed? Was life desirable when all my friends were in such sorrow, and myself in so great distress, deprived of all the gifts both of nature and fortune? Was I so unexperienced, so ignorant, so void of reason and prudence? Had I never seen or heard any thing in my whole life? Did all I had read and studied avail nothing? What! did not I know that life is short, but the glory of generous actions permanent? When death is appointed for all, does it not seem eligible, that life, which must be wrested from us, should rather be freely devoted to the service of our country, than reserved to be worn out by the decays of nature? Was not I sensible, there has been this controversy among the wisest men, that some say, the minds of men and their consciences utterly perish at death; and others, that the minds of wise and brave men are then in their greatest strength and vigour, when they are set free from the body? The first state is not greatly to be dreaded, to be void of sense: but the other, of enjoying larger capacities, is greatly to be desired. Therefore, since I always aimed at dignity, and thought nothing was worth living for without it; how should I, who am past the consulship, and did so great things in it, be afraid to die?" Thus far Cicero. There is likewise an an ironical way of contradicting a thing, by retorting that and other things of the like nature upon the

the adverse party: Thus Cicero, in his oration against Vatinius, says: "You have objected to me, that I defended Cornelius, my old friend, and your acquaintance. But pray why should I not have defended him? Has Cornelius carried any law contrary to the omens? Has he violated any law? Has he assaulted the consul? Did he take possession of a temple by force of arms? Did he drive away the tribune, who opposed the passing a law? Has he thrown contempt upon religion? Has he plundered the treasury? Has he pillaged the state? No, these, all these, are your doings." Such an unexpected return is sometimes of great service to abate the confidence of an adversary.

A second way of confutation is, by observing some *flaw* in the reasoning of the adverse party. We shall endeavour to illustrate this from the several kinds of reasoning treated of before under *confirmation*. And first, as to syllogisms; they may be refuted, either by showing some mistake in the premises, or that the conclusion is not justly deduced from them. So when the Clodian party contended, that Milo ought to suffer death for this reason, Because he had confessed that he had killed Clodius; that argument, reduced to a syllogism, would stand thus:

He who confesses he has killed another, ought not to be allowed to see the light.
But Milo confesses this.
Therefore he ought not to live.

Now the force of this argument lies in the major or first proposition; which Cicero refutes, by proving, that the Roman people had already determined contrary to what is there asserted: "In what city (says he) do these men dispute after this weak manner? In that wherein the first capital trial was in the case of the brave Horatius, who, before the city enjoyed perfect freedom, was saved by the suffrages of the Roman people, though he confessed that he killed his sister with his own hand." But when Cicero accused Verres for mal-administration in his government of Sicily, Hortensius, who defended him, being sensible the allegations brought against him could not be denied, had no other way left to bring him off, but by pleading his military virtues in abatement, which at that time were much wanted, and very serviceable to the state. The form of the argument was this:

That the Romans then wanted good generals.
That Verres was such.
And consequently, that it was for the interest of the public that he should not be condemned.

But Cicero, who knew his design, states the argument for him in his charge; and then answers it by denying the consequence, since the crimes of Verres were of so heinous a nature, that he ought by no means to be pardoned on the account of any other qualifications: Though indeed he afterwards refutes the minor or second proposition, and shows that he had not merited the character of a good general. Enthymems may be refuted, either by showing that the antecedent is false, or the consequent not justly inferred from it. As thus, with respect to the former case;

A strict adherence to virtue has often proved detrimental.
Therefore virtue ought not constantly to be embraced.

Here the antecedent may be denied. For virtue is alway beneficial to those who strictly adhere to it, both in the present satisfaction it affords them, and the future rewards they may certainly expect from it. And as to the latter case, in this manner:

She is a mother.
Therefore she loves her children.

Now as the certainty of that inference depends upon this general assertion, That all mothers love their children, which is not true, the mistake of the reasoning may be shown from the instance of Medea and others, who destroyed their own children. As to *induction* and *example*, by which the truth or equity of a thing is proved from its likeness to one or more other things; the reasoning in either is invalid, if the things so compared can be shown not to have that similitude or agreement on which the inference is founded. One instance therefore may serve for both. As when Cicero, after the death of Cæsar, pleaded for the continuance of his laws, but not of those which were made afterwards by Mark Antony: Because, though both were in themselves invalid, and impositions upon the public liberty; yet some of Cæsar's were useful, and others could not be set aside without disturbance to the state, and injuring particular persons; but those of Antony were all detrimental to the public.

The last method of *confutation* before mentioned was, when the orator does in some sense *grant* the adversary his argument, and at the same time shows its *invalidity*. And this is done by a variety of ways, according to the different nature of the subject. Sometimes he allows what was said may be true; but pleads, that what he contends for is necessary. This was the method by which Hortensius proposed to bring off Verres, as we have already shown from Cicero, whose words are these, addressing himself to the judges; "What shall I do? which way shall I bring in my accusation? where shall I turn myself; for the character of a brave general is placed like a wall against all the attacks I can make. I know the place, I perceive where Hortensius intends to display himself. He will recount the hazards of war, the necessities of the state, the scarcity of commanders; and then he will entreat you, and do his utmost to persuade you not to suffer the Roman people to be deprived of such a commander upon the testimony of the Sicilians, nor the glory of his arms to be sullied by a charge of avarice." At other times the orator pleads, that although the contrary opinion may seem to be attended with advantage, yet that his own is more just, or honourable. Such was the case of Regulus, when his friends endeavoured to prevail with him to continue at Rome, and not return to Carthage, where he knew he must undergo a cruel death. But as this could not be done without violating his oath, he refused to hearken to their persuasions. Another way of confutation is, by retorting upon the adversary his own argument. Thus Cicero, in his defence of Ligarius, says: "You have, Tubero, that which is most desirable to an accuser, the confession of the accused party; but yet such a confession,

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confession, that he was on the same side that you, Tubero, chose yourself, and your father too, a man worthy of the highest praise. Wherefore, if there was any crime in this, you ought first to confess your own before you attempt to fasten any upon Ligarius." The orator takes this advantage where an argument proves too much, that is, more than the person designed it for, who made use of it. Not much unlike this is what they call *inversion*, by which the orator shows that the reasons offered by the opposite party make for him. So when Cæcilius urged, that the province of accusing Verres ought to be granted to him, and not to Cicero, because he had been his treasurer in Sicily at the time those crimes were committed with which he was charged, and consequently knew most of that affair; Cicero turns the argument upon him, and shows, for that very reason he was the most unfit of any man to be intrusted with his prosecution; since having been concerned with him in his crimes, he would certainly do all in his power to conceal or lessen them. Again, sometimes the charge is acknowledged, but the crime shifted off to another. Thus, when Sextius was accused of sedition, because he had got together a body of gladiators, and brought them into the forum, where a warm engagement happened between them and Clodius's faction; Cicero owns the fact, but charges the crime of sedition upon Clodius's party in being the aggressors. Another method made use of for the same purpose is to alleviate the charge, and take off the force of it, by showing, that the thing was not done with that intention which the adversary insinuates. Thus Cicero, in his defence of King Dejotarus, owns he had raised some forces, though not to invade the Roman territories, as had been alleged, but only to defend his own borders, and send aid to the Roman generals.

We have hitherto been speaking of the methods of confutation used by orators, in answering those arguments which are brought by the contrary party. But sometimes they raise such objections themselves to what they have said, as they imagine may be made by others; which they afterwards answer, the better to induce their hearers to think that nothing considerable can be offered against what they have advanced, but what will admit of an easy reply. Thus, when Cicero, at the request of the Sicilians, had undertaken the accusation of Verres, it came under debate, whether he, or Cæcilius, who had been Verres's quæstor in Sicily, should be admitted to that province. Cicero, therefore, in order to set him aside, among other arguments shows his incapacity for such an undertaking, and for that end recounts at large the qualifications necessary for an orator. Which he represents to be so many and great, that he thought it necessary to start the following objection to what he had himself said upon that subject. "But you will say perhaps, Have you all these qualifications?" To which he thus replies: "I wish I had; but it has been my constant study from my youth to gain them. And if, from their greatness and difficulty, I have not been able to attain them, who have done nothing else through my whole life; how far, do you imagine, you must be from it, who never thought of them before; and even now, when you are entering upon them, have no apprehension what, and how great, they are?" This is an effectual way of defeating an adversary, when the objection is well founded, and clearly answered. But we shall have occasion to consider this matter more largely hereafter, under the figure *prolepsis*, to which it properly relates.

Chap. VI. *Of the Conclusion.*

37

The conclusion is a recapitulation and address to the passions.

Rhetoricians make the *conclusion* of a discourse to consist of two parts: *recapitulation*, and *an address to the passions*.

1. *Recapitulation* is a summary account of what the speaker has before offered in maintenance of his subject, and is designed both to refresh the memory of the hearers, and to bring the principal arguments together into a narrow compass, that they may appear in a stronger light. Now there are several things necessary to a good repetition.

And first, it must be short and concise; since it is designed to refresh the memory, and not to burden it. For this end, therefore, the chief things only are to be touched upon; those on which the cause principally depends, and which the orator is most desirous should be regarded by his hearers. Now these are, The general heads of the discourse, with the main arguments brought to support them. But either to insist particularly upon every minute circumstance, or to enlarge upon those heads which it may be thought proper to mention, carries in it not so much the appearance of a repetition, as of a new discourse.

Again, it is convenient in a repetition to recite things in the same order in which they were at first laid down. By this means the hearers will be enabled much better to keep pace with the speaker as he goes along; and if they happen to have forgot any thing, they will the more readily recal it. And besides, this method appears most simple and open, when the speaker reviews what he has said in the same manner it was before delivered, and sets it in the clearest light for others to judge of it. But though a repetition contains only the same things which had been more largely treated of before; yet it is not necessary they should be expressed in the same words. Nay, this would many times be tiresome and unpleasant to the hearers; whereas a variety of expression is grateful, provided the sense be the same. Besides, every thing ought now to be represented in the strongest terms, and in so lively a manner as may at the same time both entertain the audience, and make the deepest impression upon their minds. We have a very exact and accurate example of repetition in Cicero's oration for Quintius. Cicero was then a young man, and seems to have kept more closely to the rules of art, than afterwards, when, by use and practice, he had gained a greater freedom of speaking. We formerly cited the partition of this speech, upon another occasion, which runs thus: "We deny, Sextus Nevius, that you were put into the possession of the estate of P. Quintius, by the prætor's edict. This is the dispute between us. I will therefore show, first, that you had no just cause to apply to the prætor for the possession of the estate of P. Quintius; then that you could not possess it by the edict; and lastly, that you did not possess it. When I have proved these three things, I will conclude." Now Cicero begins his conclusion with a repetition of those three heads, and a summary account of the several arguments he made use of under each of them. But they are too long to be here exhibited. In his

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his oration for the Manilian law, his repetition is very short. He proposed in the partition to speak to three things: The nature of the war against King Mithridates, the greatness of it, and what sort of general was proper to be intrusted with it. And when he has gone through each of these heads, and treated upon them very largely, he reduces the substance of what he has said to this general and short account: "Since therefore the war is so necessary, that it cannot be neglected; and so great, that it requires a very careful management; and you can intrust it with a general of admirable skill in military affairs, of singular courage, the greatest authority, and eminent success: do you doubt to make use of this so great a blessing, conferred and bestowed upon you by heaven, for the preservation and enlargement of the Roman state?" Indeed this repetition is made by Cicero, before he proceeds to the confutation; and not at the end of his discourse, where it is usually longer and more particular: however, this may serve to show the nature of such a recital.

But sometimes a repetition is made, by running a comparison between the speaker's own arguments and those of the adverse party; and placing them in opposition to each other. And this method Cicero takes in the conclusion of his third oration upon the Agrarian law. And here sometimes the orator takes occasion to find fault with his adversary's management, in these and such like expressions: "This part he has entirely dropt. To that he has given an invidious turn, or a false colouring. He leaves arguments, and flies to intreaties; and not without good reason, if we consider the weakness of his cause."

But when the discourse is very long, and the arguments insisted on have been many, to prevent the hearers growing out of patience by a more particular recital, the orator sometimes only just mentions such things, which he thinks of least consequence, by saying, that he omits or passes over them, till he comes to what is of greater moment, which he represents more fully. This method Cicero has taken in his defence of Cluentius; where, having run over several lesser heads in the manner now described, he then alters his expression, and introduces what was of more importance, by saying, "What I first complain of, is that wickedness, which is now discovered." And so he proceeds more particularly to recite those things which immediately related to Cluentius. And this is what the writers upon this art call *preterition*. But this much may serve for repetition or recapitulation.

2. We now proceed to the other part of the conclusion, which consists in an *address to the passions*. Indeed the orator sometimes endeavours occasionally to work upon the passions of his hearers in other parts of his discourse, but more especially in the conclusion, where he is warmest himself, and labours to make them so. For the main design of the introduction is to conciliate the hearers, and gain their attention; of the narration, proposition, and confirmation, to inform them; and of the conclusion, to move them. And therefore, to use Quintilian's words, "Here all the springs of eloquence are to be opened. It is here we secure the minds of the hearers, if what went before was well managed. Now we are past the rocks and shallows, all the sails may be hoisted. And as the greatest part of the conclusion consists in illustration, the most pompous language and strongest figures have place here." Now the passions, to which the orator more particularly addresses, differ according to the nature of the discourse. In demonstrative orations, when laudatory,—love, admiration, and emulation, are usually excited; but in invectives,—hatred, envy, and contempt. In deliberative subjects, either the hope of gratifying some desire is set in view, or the fear of some impending evil. And in judicial discourses, almost all the passions have place, but more especially resentment and pity; insomuch that most of the ancient rhetoricians mention only these two. But having treated upon the nature of the passions, and the methods suited both to excite and allay them, in a former chapter, we shall at present only add a few general observations, which may not be improper in this place, where the skill of the orator in addressing to them is more especially required.

The orator will observe what circumstances either of things, or persons, or both, will furnish him with motives proper to apply to those passions he desires to excite in the minds of his hearers. Thus Cicero, in his orations for Plancus and Sylla, moves his hearers from the circumstances of the men; but in his accusation of Verres, very frequently from the barbarity and horrid nature of his crimes; and from both, in his defence of Quintius.

But the same passion may be excited by very different methods. This is plain from the writings of those Roman satirists which are yet extant; for they have all the same design, and that is to engage men to a love of virtue, and hatred of vice: but their manner is very different, suited to the genius of each writer. Horace endeavours to recommend virtue, by laughing vice out of countenance; Persius moves us to an abhorrence and detestation of vice, with the gravity and severity of a philosopher; and Juvenal, by open and vehement invectives. So orators make use of all these methods in exciting the passions; as may be seen by their discourses, and particularly those of Cicero. But it is not convenient to dwell long upon the same passion. For the image thus wrought up in the minds of the hearers does not last a great while; but they soon return to reflection. When the emotion, therefore, is once carried as high as it well can be, they should be left under its influence, and the speaker proceed to some new matter, before it declines again.

Moreover, orators sometimes endeavour to raise contrary passions to each other, as they are concerned for opposite parties. So the accuser excites anger and resentment, but the defendant pity and compassion. At other times, one thinks it sufficient to allay and take off that passion which the other has raised, and bring the hearers to a calm and sedate consideration of the matter before them.

But this especially is to be regarded, that the orator express the same passion himself with which he endeavours to affect others; and that not only in his action and voice, but likewise in his language: and therefore his words, and manner of expression, should be suited to that perturbation and disorder of mind which he designs to represent. However, a decency and propriety of character is always carefully to be observed; for, as Cicero very well remarks, "A neglect of this is not only very culpable in life, but like-wise

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wise in discourse. Nor do the same things equally become every speaker, or every audience; nor every time, and every place." And therefore he greatly commends that painter, who, designing to represent in a picture the sacrifice of Iphigenia, Agamemnon's daughter, drew Calchas the priest with a sad countenance; Ulysses, her father's great friend, more dejected; and her uncle Menelaus, most disconsolate; but threw a veil over the face of Agamemnon himself, as being unable to express that excess of sorrow which he thought was proper to appear in his countenance. And this justness of character is admirably well observed by Cicero himself, in his defence of Milo; for as Milo was always known to be a man of the greatest resolution, and most undaunted courage, it was very improper to introduce him (as the usual method then was in capital cases) moving pity, and begging for mercy. Cicero therefore takes this part upon himself; and what he could not do with any propriety in the person of Milo, he performs in his own, and thus addresses the judges: "What remains, but that I entreat and beseech you, that you would show that compassion to this brave man, for which he himself does not solicit, but I, against his inclination, earnestly implore and request. Do not be less inclined to acquit him, if in this our common sorrow, you see no tear fall from Milo's eyes; but perceive in him the same countenance, voice, and language, as at other times, steady and unmoved. Nay, I know not whether for this reason, you ought not much sooner to favour him: For if, in the contests of gladiators (persons of the lowest condition and fortune in life), we are wont to be displeased with the timorous and suppliant, and those who beg for their life; but interpose in favour of the brave and courageous, and such as expose themselves to death; and we show more compassion to those who do not sue for it, than to those who do: with how much greater reason ought we to act in the same manner towards the bravest of our fellow citizens?" And as these words were agreeable to his own character, while soliciting in behalf of another; so, immediately after, he introduces Milo speaking like himself, with a generous and undaunted air: "These words of Milo (says he) quite sink and dispirit me, which I daily hear from him. Farewell, farewell, my fellow citizens, farewell! may you be happy, flourish, and prosper; may this renowned city be preserved, my most dear country, however it has treated me; may it continue in peace, though I cannot continue in it, to whom it owes its peace. I will retire, I will be gone."

But as persons are commonly more affected with what they see than with what they hear, orators sometimes call in the assistance of that sense in moving the passions. For this reason it was usual among the Romans, in judicial cases, for accused persons to appear with a dejected air and a sordid garb, attended by their parents, children, or other relations and friends, with the like dress and aspect; as likewise to show their scars, wounds, bloody garments, and other things of the like nature, in open court. So when, upon the death of Cæsar, Mark Antony harangued the populace, he at the same time exposed to their view the garment in which he was stabbed, fixed upon a pole; at which sight they were so enraged, that immediately they ran with lighted torches to set fire to the houses of the conspirators. But this custom at last became so common, and was sometimes so ill conducted, that the force of it was greatly abated, as we learn from Quintilian. However, if the Romans proceeded to an excess on the one hand, the strictness of the Areopagites at Athens may perhaps be thought too rigid on the other; for in that court, if the orator began to say any thing which was moving, an officer immediately stood up and bade him be silent. There is certainly a medium between these two extremes, which is sometimes not only useful, but even necessary; for as Quintilian very justly says, "It is necessary to apply to the passions, when those things which are true, just, and of common benefit, cannot be come at any other way."

Chap. VII. *Of Digression, Transition, and Amplification.*

38 Digression, transition, and amplification, defined, and explained.

The number, order, and nature of the parts which constitute a complete and regular oration, we have endeavoured to explain in several preceding chapters. But there are two or three things yet remaining, very necessary to be known by an orator, which seem most properly to come under the second branch of his art. And these are, *Digression*, *Transition*, and *Amplification*.

I. *Digression*, as defined by Quintilian, is, "A going off from the subject we are upon to some different thing, which may however be of service to it." We have a very beautiful instance of this in Cicero's defence of Cœlius, who was accused of having first borrowed money of Clodia, and then engaging her servants to poison her. Now, as the proof of the fact depended upon several circumstances, the orator examines them separately; and shows them to be all highly improbable. "How (says he) was the design of this poison laid? Whence came it? how did they get it? by whose assistance, to whom, or where, was it delivered?" Now to the first of these queries he makes the accuser give this answer: "They say Cœlius had it at home, and tried the force of it upon a slave provided on purpose, whose sudden death proved the strength of the poison." Now as Cicero represents the whole charge against Cœlius as a fiction of Clodia, invented out of revenge for some slights he had put upon her; to make this the more probable, he insinuates that she had poisoned her husband, and takes this opportunity to hint it, that he might show how easy it was for her to charge another with poisoning a servant, who had done the same to her own husband. But not contented with this, he steps out of his way, and introduces some of the last words of her husband Metellus, to render the fact more barbarous and shocking, from the admirable character of the man. "O immortal gods! why do you sometimes wink at the greatest crimes of mankind, or delay the punishment of them to futurity! For I saw, I myself saw (and it was the most doleful scene of my whole life) when Q. Metellus was taken from the bosom of his country; and when he, who thought himself born to be serviceable to this state, within three days after he had appeared with such advantage in the senate, in the forum, and everywhere in public, was snatched from us in the flower of his age, and prime of his strength and vigour. At which time, when

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when he was about to expire, and his mind had lost the sense of other things, still retaining a concern for the public, he looked upon me, as I was all in tears, and intimated in broken and dying words how great a storm hung over the city and threatened the whole state; often striking the wall which separated his house from that of Quintus Catulus, and frequently calling both upon him and me, and seeming to grieve not so much at the approach of his own death, as that both his country and I should be deprived of his assistance. Had he not been wickedly taken off on a sudden, how would he after his consulship have withstood the fury of his kinsman Publius Clodius, who, while in that office, threatened, in the hearing of the senate, to kill him with his own hand, when he first began to break out? And will this woman dare to come out of those doors, and talk of the force of poison? will not she fear, lest the house itself should speak the villany? will not she dread the conscious walls, nor that sad and mournful night? But I return to the accusation." And then he proceeds to consider and refute the several circumstances of the accusation. All this was no part of his argument; but having mentioned the charge of poison, he immediately takes occasion to introduce it, in order to excite the indignation of the hearers against Clodia, and invalidate the prosecution as coming from a person of her character. Digression cannot properly be said to be a necessary part of a discourse; but it may sometimes be very convenient, and that upon several accounts.

As first, when a subject is of itself flat and dry, or requires close attention, it is of use to relieve and unbend the mind by something agreeable and entertaining. For which reason Quintilian observes, that the orators of his time generally made an excursion in their harangues upon some pleasing topic, between the narration and the proof. But he condemns the practice as too general; for while they seemed to think it necessary, it obliged them sometimes to bring in things trifling and foreign to the purpose. Besides, a digression is confined to no one part of a discourse, but may come in anywhere, as occasion offers; provided it fall in naturally with the subject, and be made some way subservient to it. We never meet with it in Cicero, without some evident and good reason. So in his prosecution of Verres for his barbarous and inhuman outrages against the Sicilians, he takes an occasion to launch out in a beautiful description of the island, and to recount the advantages which accrued from it to the Romans. His subject did not necessarily lead him to this, but his view in it was to heighten and aggravate the charge against Verres.

Again, as a *digression* ought not to be made without sufficient reason, so neither should it be too frequent. And he who never does it but where it is proper and useful, will not often see occasion for it. Frequently to leave the subject, and go off to other things, breaks the thread of the discourse, and is apt to introduce confusion. Indeed some kinds of writing admit of a more frequent use of digressions than others. In history they are often very serviceable. For as that consists of a series of facts, and a long continued narrative without variety is apt to grow dull and tedious; it is necessary at proper distances to throw in something entertaining, in order to enliven it, and keep up the attention. And accordingly we find the best historians often embellish their writings with descriptions of cities, rivers, and countries, as likewise with the speeches of eminent persons upon important occasions, and other ornaments to render them the more pleasing and delightful. Poets take a still greater liberty in this respect; for as their principal view is most commonly to please, they do not attend so closely to connection; but as an image offers itself, which may be agreeably wrought up, they bring it in, and go off more frequently to different things, than other writers.

Another property of a *digression* is, that it ought not to be too long, lest the hearers forget what preceded, before the speaker again returns to his subject.

For a digression being no principal part of a discourse, nor of any further use than as it serves some way or other to enforce or illustrate the main subject; it cannot answer this end, if it be carried to such a length, as to cause that either to be forgotten or neglected. And every one's memory will not serve him to connect together two parts of a discourse, which lie at a wide distance from each other. The better therefore to guard against this, it is not unusual with orators, before they enter upon a digression of any considerable length, to prepare their hearers by giving them notice of it, and sometimes desiring leave to divert a little from the subject. And so likewise at the conclusion they introduce the subject again by a short transition. Thus Cicero in the example cited above, when he has finished his digression concerning the death of Metellus, proceeds to his subject again with these words: "But I return to the accusation."

Indeed we find orators sometimes, when sore pressed, and the cause will not bear a close scrutiny, artfully run into digressions with a design to divert the attention of the hearers from the subject, and turn them to a different view. And in such cases, as they endeavour to be unobserved, so they do it tacitly without any transition or intimation of their design; their business being only to get clear of a difficulty, till they have an opportunity of entering upon some fresh topic.

39 Transitions often used on various occasions.

II. *Transitions* are often used not only after a digression, but likewise upon other occasions. A transition is, "A form of speech, by which the speaker in a few words tells his hearers both what he has said already, and what he next designs to say." Where a discourse consists of several parts, this is often very proper in passing from one to another, especially when the parts are of a considerable length; for it assists the hearers to carry on the series of the discourse in their mind, which is a great advantage to the memory. It is likewise a great relief to the attention, to be told when an argument is finished, and what is to be expected next. And therefore we meet with it very frequently in history. But we consider it at present only as made use of by orators. Cicero, in his second oration against Catiline, who had then left Rome, having at large described his conduct and designs, he adds, "But why do I talk so long concerning one enemy, and such an one; who owns himself an enemy, and whom I do not fear, since, what I always desired, there is now a wall between us; and say nothing

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of those, who conceal themselves, who remain at Rome, and among us?" And then he proceeds to give an account of the other conspirators.

But sometimes, in passing from one thing to another, a general hint of it is thought sufficient to prepare the hearers, without particularly specifying what has been said, or is next to follow. Thus Cicero in his second Philippic says, "But those things are old, this is yet fresh." And again: "But I have insisted too long upon trifles; let us come to things of greater moment." And at other times, for greater brevity, the transition is imperfect, and mention made only of the following head, without any intimation of what has been said already. As in Cicero's defence of Muræna, where he says: "I must now proceed to the third part of my oration concerning the charge of bribery." And soon after: "I come now to Cato, who is the support and strength of this charge."

40 Amplification defined and explained.

III. The third and last head is, *Amplification*. Now by amplification is meant, not barely a method of enlarging upon a thing: but so to represent it in the fullest and most comprehensive view, as that it may in the liveliest manner strike the mind and influence the passions. Cicero, speaking of this, calls it *the greatest commendation of eloquence;* and observes, "that it consists not only in magnifying and heightening a thing, but likewise in extenuating and lessening it." But though it consists of these two parts, and may be applied either way; yet to amplify, is not to set things in a false light, but to paint them in their just proportion and proper colours, suitable to their nature and qualities. Rhetoricians have observed several ways of doing this.

One is to ascend from a particular thing to a general. Thus Cicero, in his defence of Archias, having commended him as an excellent poet, and likewise observed, that all the liberal arts have a connection with each other, and a mutual relation between them, in order to raise a just esteem of him in the minds of his hearers, takes occasion to say many things in praise of polite literature in general, and the great advantages that may be received from it. "You will ask me (says he), why we are so delighted with this man? Because he supplies us with those things which both refresh our minds after the noise of the forum, and delight our ears when wearied with contention. Do you think we could either be furnished with matter for such a variety of subjects, if we did not cultivate our minds with learning; or bear such a constant fatigue, without affording them that refreshment? I own I have always pursued these studies; let those be ashamed, who have so given up themselves to learning, as neither to be able to convert it to any common benefit, nor discover it in public. But why should it shame me, who have so lived for many years, that no advantage or ease has ever diverted me, no pleasure allured me, nor sleep retarded me from this pursuit. Who then can blame me, or who can justly be displeased with me, if I have employed that time in reviewing these studies, which has been spent by others in managing their affairs, in the celebration of festivals or other diversions, in refreshments of mind and body, in unseasonable banquets, in dice, or tennis? And this ought the rather to be allowed me, because my ability as an orator has been improved by those pursuits, which, such as it is, was never wanting to assist my friends. And if it be esteemed but small, yet I am sensible from what spring I must draw those things which are of the greatest importance." With more to the same purpose; from which he draws this inference: "Shall I not therefore love this man? shall I not admire him? shall I not by all means defend him?"

A contrary method to the former is, to descend from a general to a particular. As if any one, while speaking in commendation of eloquence, should illustrate what he says from the example of Cicero, and show the great services he did his country, and the honours he gained to himself, by his admirable skill in oratory. Our common way of judging of the nature of things is from what we observe in particular instances, by which we form general notions concerning them. When therefore we consider the character of Cicero, and the figure he made in the world, it leads us to conclude, there must be something very admirable in that art by which he became so celebrated. And this method he has taken himself in his oration for the Manilian law, where having first intimated the scarcity of good generals at that time among the Romans, he then describes the virtues of a complete commander as a proof of it, and shows how many and great qualifications are necessary to form such a character, as courage, prudence, experience, and success: all which he afterwards applies to Pompey.

A third method is by an enumeration of parts. So when Cicero, upon the defeat of Mark Antony before Mutina, proposed that a funeral monument should be erected in honour of the soldiers who were killed in that battle, as a comfort to their surviving relations; he does it in this way, to give it the greater weight: "Since (says he) the tribute of glory is paid to the best and most valiant citizens by the honour of a monument, let us thus comfort their relations, who will receive the greatest consolation in this manner; their parents who produced such brave defenders of the state; their children who will enjoy these domestic examples of fortitude; their wives, for the loss of such husbands, whom it will be more fitting to extol than lament; their brethren, who will hope to resemble them no less in their virtues than their aspect. And I wish we may be able to remove the grief of all these by our resolutions." Such representations greatly enlarge the image of a thing, and afford the mind a much clearer view of it than if it were contracted into one single proposition.

Again, another method not much unlike the former is, when any thing is illustrated from a variety of causes. Thus Cicero justifies his behaviour in retiring, and not opposing his enemies, when they spirited up the mob in order to banish him, from the following reasons, which at that time determined him to such a conduct: "When (says he) unless I was given up, so many armed fleets seemed ready to attack this single ship of the state, tossed with the tempests of seditions and discords, and the senate was now removed from the helm; when banishment, murder, and outrage, were threatened; when some, from an apprehension of their own danger, would not defend me; others were incited by an inveterate hatred to all good men, others thought I stood in the way, others took this opportunity to express their resentment, others envied the peace and tranquillity

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tranquillity of the state; and upon all these accounts I was particularly struck at: should I have chosen rather to oppose them (I will not say to my own certain destruction, but to the greatest danger both of you and your children), than alone to submit to and undergo what threatened us all in common?" Such a number of reasons brought together, must set a thing in a very strong and clear light.

The like may be said of a number and variety of effects. Thus Cicero describes the force and excellence of oratory from its great and surprising effects, when he says, "Nothing seems to be more excellent, than by discourse to draw the attention of a whole assembly, delight them, and sway their inclinations different ways at pleasure. This, in every free state, and especially in times of peace and tranquillity, has been always in the highest esteem and reputation. For what is either so admirable, as for one only, or a very few, out of a vast multitude, to be able to do that which all have a natural power of doing? or so delightful to hear, as a judicious and solid discourse in florid and polite language? or so powerful and grand, as to influence the populace, the judges, the senate, by the charms of eloquence? Nay, what is so noble, so generous, so munificent, as to afford aid to supplicants, to support the afflicted, give safety, deliver from dangers, and preserve from exile? Or what is so necessary as to be always furnished with arms to guard yourself, assert your right, or repel injuries? And, not to confine our thoughts wholly to the courts of justice or the senate, what is there in the arts of peace more agreeable and entertaining than good language and a fine way of speaking? For it is in this especially wherein we excel other animals, that we can discourse together, and convey our thoughts to each other by words. Who therefore would not esteem, and in a particular manner endeavour to surpass others in that wherein mankind principally excels brute beasts? But to proceed to its chief advantages: What else would have drawn men into societies, or taken them off from a wild and savage life, and soften them into a polite and civilized behaviour; or, when settled in communities, have restrained them by laws?" Who but, after such a description, must conceive the strongest passion for an art attended with so many great and good effects?

A thing may likewise be illustrated by its opposite. So the blessings and advantages of peace may be recommended from the miseries and calamities of war; and thus Cicero endeavours to throw contempt upon Catiline and his party, by comparing them with the contrary side: "But if, omitting all these things with which we abound, and they want, the senate, the knights, the populace, the city, treasury, revenues, all Italy, the provinces, and foreign nations; if, I say, omitting these things, we compare the causes themselves in which each side is engaged, we may learn from thence how despicable they are.—For on this side modesty is engaged, on that impudence; on this chastity, on that lewdness; on this integrity, on that fraud; on this piety, on that profaneness; on this constancy, on that fury; on this honour, on that baseness; on this moderation, on that unbridled passion. In a word, equity, temperance, fortitude, prudence, and all virtues, contend with injustice, luxury, cowardice, rashness, and all vices; plenty with want; reason with folly; sobriety with madness; and, lastly, good hope with despair. In such a contest, did men desert us, would not heaven ordain that so many and so great vices should be defeated by these most excellent virtues?"

Gradation is another beautiful way of doing this. So when Cicero would aggravate the cruelty and barbarity of Verres for crucifying a Roman citizen, which was a sort of punishment only inflicted upon slaves, he chooses this way of doing it. "It is a crime (says he) to bind a Roman citizen, wickedness to whip him, and a sort of parricide to kill him; what then must I call it to crucify him? No name can sufficiently express such a villany." And the images of things may be thus heightened, either by ascending, as in this instance; or descending, as in that which follows, relating to the same action of Verres: "Was I not to complain of or bewail these things to Roman citizens, nor the friends of our state, nor those who had heard of the Roman name; nay, if not to men, but beasts; or, to go yet further, if in the most desert wilderness, to stones and rocks; even all mute and inanimate creatures would be moved by so great and heinous cruelty."

And, to name no more, facts may be amplified from their circumstances; as time, place, manner, event, and the like. But instances of this would carry us too far; and therefore we shall only add, that as the design of *amplification* is not barely to prove or evince the truth of things, but also to adorn and illustrate them, it requires a florid and beautiful style, consisting of strong and emphatical words, flowing periods, harmonious numbers, lively tropes, and bright figures. But the consideration of these things comes under the Third Part of Oratory, upon which we are now to enter.

PART III. OF ELOCUTION.

ELOCUTION directs us to suit both the words and expressions of a discourse to the nature of the subject, or to speak with propriety and decency. This faculty is in one word called *eloquence;* and those persons who are possessed of it are therefore styled *eloquent.*

Elocution is twofold, general and particular. The former treats of the several properties and ornaments of language in common; the latter considers them as they are made use of to form different sorts of style.

I. GENERAL ELOCUTION.

41 General elocution defined.

THIS, according to rhetoricians, consists of three parts; *Elegance*, *Composition*, and *Dignity*. A discourse which has all these properties suitably adjusted, must, with respect to the language, be perfect in its kind, and delightful to the hearers.

CHAP.

Elocution.

CHAP I. *Of Elegance.*

ELEGANCE consists in two things, *Purity* and *Perspicuity:* And both these, as well with respect to single words, as their construction in sentences. These properties in language give it the name of *elegant*, for a like reason that we call other things so which are clean and neat in their kind. But in the common use of our tongue, we are apt to confound *elegance* with *eloquence;* and say, *a discourse is elegant*, when we mean by the expression, that it has all the properties of fine language.

§ 1. *Purity.*

42 Purity explained and illustrated.

By this we are to understand the choice of such words and phrases as are suited and agreeable to the use of the language in which we speak: And so grammarians reduce the faults they oppose to it to two sorts, which they call *barbarism* and *solecism;* the former of which respects single words, and the latter their construction. But we shall consider them jointly, and in a manner different from grammarians; for with them all words are esteemed pure which are once adopted into a language, and authorised by use. And as to phrases, or forms of expression, they allow them all the same claim, which are agreeable to the analogy of the tongue. But in oratory, neither all words nor all expressions are so called which occur in language; but such only as come recommended by the authority of those who speak or write with accuracy and politeness. Indeed it is a common saying *that we should think with the learned, and speak with the vulgar.* But the meaning of that expression is no more than that we should speak agreeably to the common usage of the tongue, that every one may understand us; and not choose such words or expressions as are either difficult to be understood, or may carry in them an appearance of affectation and singularity. But in order to set this matter in a clearer light, we shall here recount the principal things which vitiate the purity of language.

And first, it often happens, that such words and forms of speaking as were introduced by the learned are afterwards dropped by them as mean and sordid, from a seeming baseness contracted by vulgar use. For polite and elegant speakers distinguish themselves by their discourse, as persons of figure do by their garb; one being the dress of the mind, as the other is of the body. And hence it comes to pass, that both have their different fashions, which are often changed; and as the vulgar affect to imitate those above them in both, this frequently occasions an alteration when either becomes too trite and common. But beside these sordid words and expressions, which are rendered so by the use of the vulgar, there is another sort first introduced by them, which is carefully to be avoided by all those who are desirous to speak well. For the vulgar have their peculiar words and phrases, suited to their circumstances, and taken from such things as usually occur in their way of life. Thus in the old comedians, many things are spoken by servants, agreeable to their character, which would be very unbecoming from the mouth of a gentleman. And we cannot but daily observe the like instances among ourselves.

Again, this is common to language with all other human productions, that it is in its own nature liable to a constant change and alteration. For, as Horace has justly observed,

> All human works shall waste;
> Then how can feeble words pretend to last.

Nothing could ever please all persons, or at least for any length of time. And there is nothing from which this can less be expected than language. For as the thoughts of men are exceedingly various, and words are the signs of their thoughts, they will be constantly inventing new signs to express them by, in order to convey their ideas with more clearness, or greater beauty. If we look into the different ages of the Latin writers, what great alterations and changes do we find in their language? How few now understand the remaining fragments of the *twelve tables?* Nay, how many words do we meet with even in Plautus, the meaning of which has not yet been fixed with certainty by the skill of the best critics? And if we consider our own language, it will appear to have been in a manner entirely changed from what it was a few ages since. To mention no others, our celebrated Chaucer is to most persons now almost unintelligible, and wants an expositor. And even since our own memory, we cannot but have observed, that many words and expressions, which a few years ago were in common use, are now in a manner laid aside and antiquated; and that others have constantly succeeded, and daily do succeed in their room. So true is that observation of the same poet:

> Some words that have or else will feel decay
> Shall be restor'd, and come again in play;
> And words now fam'd shall not be fancied long;
> They shall not please the ear, nor move the tongue;
> As use shall these approve, and those condemn;
> Use, the sole rule of speech, and judge supreme.

We must therefore no less abstain from antiquated or obsolete words and phrases, than from sordid ones. Though all old words are not to be thought antiquated. By the former we mean such as, though of an ancient standing, are not yet entirely disused nor their signification lost. And from the use of these we are not to be wholly debarred, especially when they appear more significant than any others we can fix upon. But as to phrases or expressions, greater caution seems still necessary: and such as are old should doubtless, if at all, be used more sparingly. The Latin tongue was brought to its greatest perfection in the reign of Augustus, or somewhat sooner; and he himself studied it very carefully. For, as Suetonius tells us, "He applied himself to eloquence, and the study of the liberal arts, from his childhood, with great diligence and labour. He chose a manner of speaking which was smooth and elegant; he avoided the ill savour, as he used to call it, of antiquated words; and he was wont to blame Tiberius for his affectation of them." In our own language, such words are to be esteemed antiquated, which the most polite persons have dropped, both in their discourse and writings; whose example we should follow, unless we would be thought to converse rather with the dead than the living.

But further: As on the one hand we must avoid obsolete words and phrases; so, on the other, we should refrain

Elocution. refrain from new ones, or such whose use has not yet been sufficiently established, at least among those of the best taste. Words may be considered as new in two respects; either when they are first brought into a language, or when they are used in a new sense. As the former of these may sometimes leave us in the dark by not being understood, so the latter are most apt to mislead us; for when we hear a word that has been familiar to us, we are presently led to fix that idea to it with which it has usually been attended. And therefore, in both cases, some previous intimation may be necessary. Cicero, who perhaps enlarged the furniture of the Roman tongue more than any one person besides, appears always very cautious how he introduces any thing new, and generally gives notice of it when he attempts it, as appears in many instances scattered through his works. What bounds we are now to fix to the purity of the Latin tongue, in the use of it, the learned are not well agreed. It is certain, our furniture is much less than when it was a living language, and therefore the greater liberty must of necessity be sometimes taken. So that their opinion seems not unadvisable, who direct us to make choice principally of what we are furnished with from the writers of the Augustan age; and where we cannot be supplied from them, to make use of such authors as lived nearest to them, either before or since. And as to our own tongue, it is certainly prudent to be as careful how we admit any thing into it that is uncouth or disagreeable to its genius, as the ancient Romans were into theirs; for the perfection of a language does in a great measure consist in a certain analogy and harmony running through the whole, by which it may be capable of being brought to a standard.

But besides those things already mentioned, any mistake in the sense of words, or their construction, is opposed to purity. For to speak purely, is to speak correctly. And such is the nature of these faults in elocution, that they are often not so easy to be observed by hearing as by reading. Whence it is, that, many persons are thought to speak better than they write; for while they are speaking, many slips and inaccuracies escape disregarded, which in reading would presently appear. And this is more especially the case of persons unacquainted with arts and literature; who, by the assistance of a lively fancy and flow of words, often speak with great ease and freedom, and by that means please the ear; when, at the same time, what they say, would not so well bear reading.

We shall only add, that a distinction ought likewise to be made between a poetic diction and that of prose writers. For poets in all languages have a sort of peculiar dialect, and take greater liberties, not only in their figures, but also in their choice and disposition of words; so that what is a beauty in them would often appear unnatural and affected in prose.

§ 2. *Of Perspicuity.*

43 Perspicuity explained and illustrated.

Perspicuity, as well as *purity*, consists partly in *single words*, and partly in their *construction*.

44 As to single words.

I. As to *single words*, those are generally clearest and best understood which are used in their proper sense. But it requires no small attention and skill to be well acquainted with the force and propriety of words; which ought to be duly regarded, since the perspicuity of a discourse depends so much upon it. Cæsar seems plainly to have been of this mind, when he tells us, "The foundation of eloquence consists in the choice of words." It may not be amiss, therefore, to lay down some few observations, by which the distinct notions of words and their peculiar force may more easily be perceived. All words may be divided into *proper words* and *tropes*. Those are called *proper words*, which are expressed in their proper and usual sense. And *tropes* are such words as are applied to some other thing than what they properly denote, by reason of some similitude, relation, or contrariety between the two things. So, when a subtle artful man is called a *fox*, the reason of the name is founded in a similitude of qualities. If we say, *Cicero will always live*, meaning *his works*, the cause is transferred to the effect. And when we are told, *Cæsar conquered the Gauls*, we understand that he did it with the assistance of his army; where a part is put for the whole, from the relation between them. And when Cicero calls Antony *a fine guardian of the state*, every one perceives he means the contrary. But the nature and use of tropes will be explained more fully hereafter in their proper place. All words must at first have had one original and primary signification, which, strictly speaking, may be called their *proper sense*. But it sometimes happens, through length of time, that words lose their original signification, and assume a new one, which then becomes their proper sense. So *hostis* in the Latin tongue at first signified a *stranger;* but afterwards that sense of the word was entirely laid aside, and it was used to denote a *public enemy*. And in our language, it is well known, that the word *knave* anciently signified a *servant*. The reason of the change seems to be much the same, as in that of the Latin word *latro;* which first signified a *soldier*, but afterwards a *robber*. Besides, in all languages, it has frequently happened, that many words have gradually varied from their first sense to others somewhat different; which may, notwithstanding, all of them, when rightly applied, be looked upon as proper. Nay, in process of time, it is often difficult to say which is the original, or most proper sense. Again, sometimes two or more words may appear to have the same signification with each other, and may therefore be used indifferently; unless the beauty of the period, or some other particular reason, determine to the choice of one rather than another. Of this kind are the words *ensis* and *gladius* in the Latin tongue; and in ours, *pity* and *compassion*. And there are other words of so near an affinity to each other, or at least appear so from vulgar use, that they are commonly thought to be synonymous. Such are the words *mercy* and *pity;* though mercy in its strict sense is exercised towards an offender, and pity respects one in distress. As this peculiar force and distinction of words is carefully to be attended to, so it may be known several ways. Thus the proper signification of substantives may be seen by their application to other substantives. As in the instance just now given, a person is said to show *mercy to a criminal*, and *pity to one in distress*. And in the like manner, verbs are distinguished, by being joined to some certain nouns, and not to others. So a person is said *to command an inferior*, *to intreat a superior*, and *to desire an equal*. Adjectives also, which denote the properties

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properties of things, have their signification determined by those subjects to which they most properly relate. Thus we say, *an honest mind*, and *a healthful body; a wise man*, and *a fine house*. Another way of distinguishing the propriety of words, is by their use in gradations. As if one should say, *Hatreds, grudges, quarrels, tumults, seditions, wars, spring from unbridled passions*. The proper sense of words may likewise be known by observing to what other words they are either opposed, or used as equivalent. So in that passage of Cicero, where he says, "I cannot perceive why you should be angry with me: if it be because I defend him whom you accuse, why may not I be displeased with you for accusing him whom I defend? You say, I accuse my enemy; and I say, I defend my friend." Here the words *accuse* and *defend, friend* and *enemy*, are opposed; and *to be angry* and *displeased*, are used as terms equivalent. Lastly, the derivation of words contributes very much to determine their true meaning. Thus because the word *manners* comes from the word *man*, it may properly be applied either to that or any other put for it. And therefore we say, *the manners of men*, and *the manners of the age*, because the word *age* is there used for *the men of the age*. But if we apply the word *manners* to any other animal, it is a trope. By these and such like observations we may perceive the proper sense and peculiar force of words, either by their connection with other words, distinction from them, opposition to them, equivalency with them, or derivation. And by thus fixing their true and genuine signification, we shall easily see when they become tropes. But though words, when taken in their proper signification, generally convey the plainest and clearest sense; yet some are more forcible, sonorous, or beautiful, than others. And by these considerations we must often be determined in our choice of them. So whether we say, *he got*, or *he obtained, the victory*, the sense is the same; but the latter is more full and sonorous. In Latin, *timeo* signifies *I fear; pertimeo* is more full and significant; and *pertimesco* more sonorous than either of the former. The Latin and Greek languages have much the advantage of ours in this respect, by reason of their compositions; by the help of which they can often express that in one word for which we are obliged to put two words, and sometimes more. So *pertimeo* cannot be fully expressed in our language by one word; but we are forced to join one or two particles to the verb, to convey its just idea, and say, *I greatly*, or *very much fear:* and yet even then we scarce seem to reach its full force. As to tropes, though generally speaking they are not to be chosen where plainness and perspicuity of expression is only designed, and proper words may be found; yet through the penury of all languages, the use of them is often made necessary. And some of them, especially metaphors, which are taken from the similitude of things, may, when custom has rendered them familiar, be considered as proper words, and used in their stead. Thus, whether we say *I see your meaning*, or, *I understand your meaning*, the sense is equally clear, though the latter expression is proper, and the former metaphorical, by which the action of seeing is transferred from the eyes to the mind.

45
As to the construction of sentences.

II. But *perspicuity* arises not only from a choice of *single words*, but likewise from the *construction* of them in sentences. For the meaning of all the words in a sentence, considered by themselves, may be very plain and evident; and yet, by reason of a disorderly placing them, or confusion of the parts, the sense of the whole may be very dark and obscure. Now it is certain that the most natural order is the plainest; that is, when both the words and parts of a sentence are so disposed, as best agrees with their mutual relation and dependence upon each other. And where this is changed, as is usually done, especially in the ancient languages, for the greater beauty and harmony of the periods; yet due regard is had by the best writers to the evidence and perspicuity of the expression.

But to set this subject in a clearer light, on which the perfection of language so much depends, we shall mention some few things which chiefly occasion obscurity; and this either with respect to single words, or their construction.

And first, all ambiguity of expression is one cause of obscurity. This sometimes arises from the different senses in which a word is capable of being taken. So we are told, that upon Cicero's addressing himself to Octavius Cæsar, when he thought himself in danger from his resentment, and reminding him of the many services he had done him, Octavius replied, *He came the last of his friends*. But there was a designed ambiguity in the word *last*, as it might either respect the time of his coming, or the opinion he had of his friendship. And this use of ambiguous words we sometimes meet with, not only in poetry, where the turn and wit of an epigram often rest upon it, but likewise in prose, either for pleasantry or ridicule. Thus Cicero calls Sextus Clodius *the light of the senate*, which is a compliment he pays to several great men, who had distinguished themselves by their public services to their country. But Sextus, who had a contrary character, was a relation of P. Clodius, whose dead body, after he had been killed by Milo, he carried in a tumultuous manner into the senate-house, and there burnt it with the senators benches, in order to inflame the populace against Milo. And it is in allusion to that riotous action, that Cicero, using this ambiguous expression, calls him *the light of the senate*. In such instances, therefore, it is a beauty, and not the fault we are cautioning against: as the same thing may be either good or bad, as it is differently applied.—Though even in such designed ambiguities, where one sense is aimed at, it ought to be sufficiently plain, otherwise they lose their intention. And in all serious discourses they ought carefully to be avoided. But obscurity more frequently arises from the ambiguous construction of words, which renders it difficult to determine in what sense they are to be taken. Quintilian gives us this example of it: "A certain man ordered in his will, that his heir should erect for him a statue holding a spear made of gold." A question arises here, of great consequence to the heir from the ambiguity of the expression, whether the words *made of gold* are to be applied to the *statue* or the *spear;* that is, whether it was the design of the testator by this appointment, that the whole statue, or only the spear, should be made of gold. A small note of distinction, differently placed between the parts of this sentence, would clear up the doubt, and determine the sense either way

Elocution. way. For if one comma be put after the word *statue*, and another after *spear*, the words *made of gold* must be referred to the statue, as if it had been said, *a statue, made of gold, holding a spear*. But if there be only the first comma placed after *statue*, it will limit the words *made of gold* to the *spear* only; in the same sense as if it had been said, *A statue holding a golden spear*. And either of these ways of expression would in this case have been preferable, for avoiding the ambiguity, according to the intention of the testator. The ancient heathen oracles were generally delivered in such ambiguous terms. Which, without doubt, were so contrived on purpose, that those who gave out the answers might have room left for an evasion. See ORACLE.

Again, obscurity is occasioned either by too short and concise a manner of speaking, or by sentences too long and prolix; either of these extremes have sometimes this bad consequence. We find an instance of the former in Pliny the Elder, where speaking of hellebore, he says, "They forbid it to be given to aged persons and children, and less to women than men." The verb is wanting in the latter part of the sentence, *and less to women than men:* which in such cases being usually supplied from what went before, would here stand thus; *and they forbid it to be given less to women than men*. But this is directly contrary to the sense of the writer, whose meaning is, either that it is ordered to be given in a less quantity to women than men, or not so frequently to women as men. And therefore the word *order* is here to be supplied, which being of a contrary signification to *forbid*, expressed in the former part of the sentence, occasions the obscurity. That long periods are often attended with the same ill effect, must be so obvious to every one's experience, that it would be entirely needless to produce any examples in order to evince the truth of it. And therefore we shall only observe, that the best way of preventing this seems to be by dividing such sentences as exceed a proper length into two or more; which may generally be done without much trouble.

Another cause of obscurity, not inferior to any yet mentioned, is *parenthesis*, when it is either too long or too frequent. This of Cicero, in his oration for Sylla, is longer than we usually find in him: "O immortal gods! (for I must attribute to you what is your own; nor indeed can I claim so much to my own abilities, as to have been able of myself to go through so many, so great, such different affairs, with that expedition, in that boisterous tempest of the state), you inflamed my mind with a desire to save my country." But where any obscurity arises from such sentences, they may frequently be remedied by much the same means as was just now hinted concerning long and prolix periods; that is, by separating the parenthesis from the rest of the sentence, and placing it either before or after. So in this sentence of Cicero, the parenthesis may stand last, in the following manner:— "O immortal gods! you inflamed my mind with a desire to save my country: for I must attribute to you what is your own; nor indeed can I claim so much to my own abilities, as to have been able of myself to go through so many, so great, such different affairs, with that expedition, in that boisterous tempest of the state." This order of the sentence is very plain, and less involved than the former. Elocution.

CHAP. II. *Of Composition.*

46 Composition defined and divided.

COMPOSITION, in the sense it is here used, gives rules for the structure of sentences, with the several members, words, and syllables, of which they consist, in such a manner as may best contribute to the force, beauty, and evidence of the whole.

Composition consists of four parts, which rhetoricians call *period, order, juncture*, and *number*. The first of these treats of the structure of sentences; the second, of the parts of sentences, which are words and members; and the two last, of the parts of words, which are letters and syllables. For all articulate sounds, and even the most minute parts of language, come under the cognizance of oratory.

§ 1. *Of Period.*

47 Period defined and explained.

In every sentence or proposition, something is said of something. That of which something is said, logicians call the *subject*, and that which is said of it, the *predicate:* but in grammatical terms, the former is *a noun substantive of the nominative case*, and the latter *a finite verb*, denoting affirmation, and some state of being, acting, or suffering. These two parts may of themselves constitute a sentence: As when we say, *The sun shines*, or *the clock strikes*, the words *sun* and *clock* are the subject in these expressions, *shines* and *strikes* imply each the copula and predicate. Most commonly, however, the noun and the verb are accompanied with other words, which in grammatical construction are said either to be connected with or to depend upon them; but in a logical consideration they denote some property or circumstance relating to them. As in the following sentence: *a good man loves virtue for itself*. The subject of this sentence is *a good man:* and the predicate, or thing affirmed of him, that he *loves virtue for itself*. But the two principal or necessary words, on which all the rest depend, are *man* and *loves*. Now, a simple sentence consists of one such noun and verb, with whatever else is joined to either or both of them. And a compound sentence contains two or more of them; and may be divided into so many distinct propositions, as there are such nouns and verbs, either expressed or understood. So in the following sentence, *Compliance gains friends but truth procures hatred*, there are two members, each of which contains in it an entire proposition. For, *Compliance gains friends* is one complete sentence, and *Truth procures hatred* is another; which are connected into one compound sentence by the particle *but*. Moreover, it frequently happens, that compound sentences are made up of such parts or members, some if not all of which are themselves compounded, and contain in them two or more simple members. Such is that of Sallust: "Ambition has betrayed many persons into deceit; to say one thing, and to mean another; to found friendship and enmity, not upon reason, but interest; and to be more careful to appear honest, than really to be so." This sentence consists of four members; the last of which three, consisting of opposite parts, are all compounded, as will

appear

appear by expressing them at length in the following manner; *Ambition has betrayed many persons into deceit;* [that is, ambition] *has betrayed them to say one thing, and to mean another; it has betrayed them to found friendship and enmity, not upon reason, but interest; and it has betrayed them to be more careful to appear honest, than really to be so.* The three last of these members, beginning with the words *it betrays*, are all of them compounded, and consists of two opposite members; which might each of them be expressed at length in the same manner, by supplying the ellipsis. As, *Ambition has betrayed many persons to say one thing, and it has betrayed them to mean another.* And so of the rest. From this instance we see how much is left to be supplied by the mind in all discourse, which if expressed would both destroy its harmony and render it exceedingly tedious. But still regard must be had to that which is omitted, so as to render what is said consistent with it; otherwise there can be no propriety in what is spoken. Nor can the members of a sentence be distinguished and duly arranged in their proper order, without this. But to proceed: Some sentences consist either wholly, or in part, of such members as contain in them two or more compound ones, which may therefore, for distinction's sake, be called *decompound members.*—Of this kind is that of Cicero, in his defence of Milo: "Great is the force of conscience, great either way: that those persons are not afraid who have committed no offence; and those who have offended always think punishment present before their eyes." The latter member of this sentence, which begins with the word *that*, contains in it two compound members, which represent the different state of mind between innocent and guilty persons. And it is in the proper distinction and separation of the members in such complex sentences that the art of pointing chiefly consists. For the principal use of a comma is to divide the simple members, a semicolon the compound ones, a colon such as are decompounded, and a period the whole from the following sentence. We mention this the rather, to show the different acceptation of these terms by grammarians, from that of the ancient writers upon oratory. For these latter apply them to the sense, and not to any points of distinction. A very short member, whether simple or compound, with them is a comma, and a longer a colon; for they have no such term as a semicolon. Besides, they call a very short sentence, whether simple or compound, a *comma*, and one of somewhat a greater length, a *colon*. And therefore if a person expressed himself either of these ways in any considerable number of sentences together, he was said to speak by commas or colons. But a sentence containing more words than will consist with either of these terms, they call a simple period; the least compound period with them requiring the length of two colons. However, this way of denominating sentences, and the parts of them, rather from their length than the nature of them, appearing not so suitable, we have chosen rather to make use of the terms *simple* and *compound members;* and to call all those *compound periods*, which contain two or more members, whether simple or compounded.

But to proceed: Sentences, with respect to their form or composition, are distinguished into two sorts, called by Cicero *tracta*, "straight or direct;" and *contorta*, "bent or winding." By the former are meant those whose members follow each other in a direct order, without any inflection; and by the latter, those which strictly speaking are called *periods.* For περιοδος in Greek signifies a *circuit* or *circle.* And so the Latins call it *circuitus* and *ambitus.* By which both of them mean a sentence consisting of correspondent parts, so framed, that the voice in pronouncing them may have a proper elevation and cadency, and distinguish them by its inflection; and as the latter part returns back, and unites with the former, the period, like a circle, surrounds and incloses the whole sense. This elevation of the voice in the former part of the period, is by the Greeks called προτασις, and by the Latins *propositio;* and the depression of it in the latter part, by the one αποδοσις, and by the other *redditio.*

Now as simple sentences have not these correspondent parts, which require any inflection of the voice; nor a circular form, by reason of their brevity; they are not properly periods, in the strict sense of the word: though, in common speech, the words *sentence* and *period* are often used as equivalent terms. Thus, if we say, *Generous minds are incited to the performance of noble exploits from motives of glory;* here is no distinction of parts, nor inflection of the voice in this sentence. And indeed there is not any thing which relates to the structure of these sentences, but what will more properly be taken notice of in the second part of *composition*, which is *order.*

And as to those compound sentences, whose members follow each other in a direct order, without any inflection, there is little art required in their composition. We shall produce one example of this kind from Cicero: "Natural reason inclines men to mutual converse and society; and implants in them a strong affection for those who spring from them; and excites them to form communities, and join in public assemblies; and, for these ends, to endeavour to procure both the necessaries and conveniences of life: and that not for themselves only, but likewise for their wives, children, and others who are dear to them, and have a right to their assistance." Here are five short members in this sentence, placed in a series, without any inflection of the parts, or orbit of the whole. And as such sentences have no other boundary but the conclusion of the sense, suited to the breath of the speaker, he may either contract or lengthen them at pleasure, without offending the ear. So, should the sentence last mentioned conclude with the first member in this manner, *Natural reason inclines men to mutual converse and society;* the sense would be perfect, and the ear satisfied. The case would be the same at the end of the second member, thus: *Natural reason inclines men to mutual converse and society, and implants in them a strong affection for those who spring from them.* And the like may be said of the rest. Since such sentences therefore may be thus limited at pleasure, it seems more convenient both for the speaker and hearers to confine them to a moderate length.

But because the principal art relating to this part of composition lies in the frame and structure of such compound sentences as are properly called *periods*, we shall treat upon these somewhat more largely. In the formation

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tion of these periods, two things are chiefly to be regarded; their *length* and *cadency*. As the length ought to be suited to the breath of the speaker, the ancient rhetoricians scarce admit of more than four colons; by which we may here understand compound members of a moderate size, which will be generally found a suitable and proportionate length. For to extend them farther than the voice can well manage, must be painful to the speaker, and of consequence unpleasant to the hearers. As to the cadency, what Cicero has observed, is found true by experience, that the ears judge what is full and what is deficient; and direct us to fill up our periods, that nothing be wanting of what they expect. When the voice is raised at the beginning of a sentence, they are in suspense till it be finished; and are pleased with a full and just cadency, but are sensible of any defect, and are displeased with redundancy. Therefore care must be taken that periods be neither deficient, and as it were maimed, that is, that they do not drop before their time, and defraud the ears of what seemed to be promised them; nor, on the other hand, offend them by too long and immoderate excursions. This rise and cadency of the voice in pronunciation, depend on the nature and situation of the members, as we shall endeavour to show by particular instances; in the explication of which, by the word *members*, are to be understood such as are uncompounded. In a period of two members, the turn of the voice begins with the latter member. Of this kind is the following sentence of Cicero: "If impudence prevailed as much in the forum and courts of justice, as insolence does in the country and places of less resort; Aulus Cæcina would submit as much to the impudence of Sextus Ebutius in this cause, as he did before to his insolence when assaulted by him." Here the cadency begins at the words *Aulus Cæcina*. If a sentence consists of three members, the inflection is best made at the end of the second member: for if it begin immediately after the first, the voice will be either apt to sink too low, and not be heard, before it reach the end; or else be precipitated, in order to prevent it. Cicero begins his oration for Milo with a sentence of this form: "Although I fear, it may be a shame to be dismayed at the entrance of my discourse in defence of a most valiant man; and that it nowise becomes me, while Milo is more concerned for the safety of the state than for himself, not to show the same greatness of mind in his behalf: *yet* this new form of prosecution terrifies my eyes, which, whatever way they turn, want the ancient custom of the forum, and former manner of trials." Here the cadency, beginning at the third member with the word *yet*, makes a proper division of the sentence, and easy for the speaker. But a period of four members is reckoned the most complete and perfect, where the inflection begins at the middle, that is, with the third member. Nor is it the same case here, as if, in a sentence of three members, the cadency be made at the second. For in proportion to the time of raising the voice may the space be allowed for its sinking. The following sentence of Cicero gives us an instance of this, where he speaks to his son: "Although, son Mark, having now been a hearer of Cratippus for a year, and this at Athens, you ought to abound in the precepts and doctrines of philosophy, by reason of the great character both of your instructor and the city; one of which can furnish you with knowledge, and the other with examples: yet, as I always to my advantage joined the Latin tongue with the Greek, and have done it not only in oratory, but likewise in philosophy; I think you ought to do the same, that you may be equally conversant in both languages." The turn in this period begins at the word *yet*; which standing near the middle, the voice is raised to that pitch in pronouncing the former part, as to admit of a gradual cadency, without being lost before the conclusion of the sentence. But where the sense does not suit with this division at the entrance upon the third member, it is best made at the fourth. Such is the following sentence of Cicero: "If I have any genius, which I am sensible is very small; or any readiness in speaking, wherein I do not deny but I have been much conversant; or any skill in oratory, from an acquaintance with the best arts, to which I confess I have been always inclined; *no one* has a better right to demand of me the fruit of all these things than this Aulus Cæcina." The cadency of this sentence does not begin till the words *no one*; yet it ends handsomely, and without disappointing the ear. Though indeed the three first members having each of them an inflection, check the elevation of the voice, and by that variety in the pronunciation add to the harmony of the sentence. An equality of the members should likewise be attended to in the composition of a period, the better to adjust their rise and cadency. And for this reason, in sentences of three members, where the cadency begins with the third; or in those of four members, where it begins at the fourth; it promotes the harmony to make the last member longest. This is properly the nature of rhetorical periods, which when rightly formed have both an equal beauty and dignity in their composition.

But as all discourse is made up of distinct sentences, and whenever we express our thoughts it is in some of the forms above mentioned; so the use of them is not promiscuous, but suited to answer different designs in speaking. And in this view they are considered and made use of by the orator, as will be shown hereafter.

§ 2. *Of Order.*

48 Order defined and illustrated.

By *order*, rhetoricians mean the placing each word and member of a sentence in such a manner as will most contribute to the force, beauty, or evidence of the whole.

Order is of two kinds, *natural* and *artificial*. And each of these may be considered with respect to the parts either of simple or compound sentences.

As to simple sentences, we may call that order *natural*, when all the words in a sentence are so placed, as they are connected with or follow each other in a grammatical construction. And it may properly enough admit of this name, as it is founded in the nature of a proposition, and the relation of the several words of which it consists to each other. This we explained in the last chapter, and illustrated by proper examples; and shall therefore only give one instance of it here, to introduce the subject we are now upon. And it is this: *The fame of Isocrates excited Aristotle to the profession of oratory.* Here these words, *the fame of Isocrates*, contain the subject of this sentence, with what relates to it; and all those which follow, *excited Aristotle to the profession of oratory*, make up the predicate and its dependents, Elocution. pendents. And in both parts each word grammatically considered stands in its proper order of construction. And this seems agreeable to the natural way of conveying our thoughts, which leads us first to express the subject or thing of which some other thing is said, before the predicate or that which is said concerning it; and with respect to both, as every idea succeeds another in the order of our conceptions, to range it in the same order when we communicate them to others. Our language in the general keeps pretty much to this method. But in one thing particularly it recedes from it; and that is, in placing adjectives, which denote the properties of things, before their substantives or subjects, whose properties they are: As when it is said, *Evil communication corrupts good manners*. And this we always do, except something follows which depends upon the adjective. So we say, *He was a man eminent for his virtue*: not *an eminent man*.

Artificial order, as it respects simple sentences, has little or no regard to the natural construction of words; but disposes them in such a manner as will be most agreeable to the ear, and best answer the design of the speaker. The Latins take a much greater liberty in this respect than we do, or than the nature of our language will permit. Quintilian says, it is best for the verb to stand last, when there is no particular reason to the contrary. And he gives this reason for it, *because the force of the sentence lies in the verb*. So that, according to him, they seem to have had this view in putting the verb at the end; that as the whole sentence is imperfect without the verb, the mind being thus held in suspense might receive the deeper impression from it at last. They likewise separate such words as have an immediate relation between them or dependence one upon another, and place any of them first or last as they please. In short their order seems in a manner arbitrary, if he does not break in upon perspicuity, to which they usually attend. But most of these things are unsuitable to the genius of our language. One might say indeed, *Convince him you cannot*: instead of saying, *You cannot convince him*: Or, *With my own eyes I saw it*; for, *I saw it with my own eyes*. And again: *in proportion to the increase of luxury the Roman state declined*: for, *The Roman state declined in proportion to the increase of luxury*. But this inversion of words is proper in English composition only when it gives force to the expression; as in the higher style it often does. It serves to impress known truths upon the mind, but is unfit for communicating the first principles of knowledge.

As to compound sentences, that is, such as consist of two or more members, either simple or compounded; what relates to the words in each member separately is the same as in simple sentences. But with regard to the disposition of the several members, that may be called the *natural order*, which so places them as they mutually depend on each other. Thus the antecedent member naturally precedes the relative; as in this expression, *Men are apt to forgive themselves what they blame in others*. In hypothetical sentences the conditional member naturally stands first. Thus: *If Socrates be a rational creature, he is a man*. That member which expresses the effect of an action naturally comes last; as, *Though you offer ever so good reasons, you will not prevail with him*. The like may be said of time, with regard to things done in it; as, *The Roman eloquence soon declined when Cicero was dead*. And to name no more, the reason of a thing naturally follows that of which it is the reason; as thus: *All the pleasures of life must be uncertain, since life itself is not secure*.

When this order is inverted, it must be styled *artificial*. So to keep to the instances already given, the two members in the first sentence may be thus inverted: *What they blame in others, men are apt to forgive themselves*. In the second, in this manner: *Socrates is a man, if he be a rational creature*. In the third, thus: *You will not prevail with him, though you offer ever so good reasons*, And so on in the rest: As, *When Cicero was dead, the Roman eloquence soon declined*; and, *Since life itself is not secure, all the pleasures of life must be uncertain*. The variety of inversions in a sentence may generally be greater or less in proportion to the number of its members. In the following sentence of Cicero, the natural order seems to be this: *If that greatness of mind be void of justice, which shows itself in dangers and labours, it is blameable*. Which may be varied by changing the place of the first and third member, in the following manner: *That greatness of mind is blameable which shows itself in dangers and labours, if it want justice*. Or by altering the place of all the three members thus: *That greatness of mind is blameable, if it be void of justice, which shews itself in dangers and labours*. But oftentimes one member may be included in another, as in the instance here given: *If that greatness of mind which shows itself in dangers and labours, be void of justice, it is blameable*. Here the relative member is included in the conditional, which is placed first, and the antecedent member follows both. But in Cicero it stands thus: *That greatness of mind, which shows itself in dangers and labours, if it want justice, is blameable*; where the relative and conditional members are both included in the antecedent member. The Latin tongue commonly admits of a much greater variety in the transposition of members, as well as in that of single words, than suits with our idiom. In the following sentence the natural order is much preferable, as it best suits with the proper elevation and cadency of the voice in its pronunciation: *I am willing to remit all that is past, provided it may be done with safety*. But should we invert the members, and say, *Provided it may be done with safety, I am willing to remit all that is past*; the harmony of the cadency would be lost. And if the latter member be included in the former, the alteration will still be worse; as, *I am willing, provided it may be done with safety, to forgive all that is past*. Here the inflection of the voice falls upon the same member as before, and destroys the beauty of the period by its elevation afterwards. Some sentences admit of no involution of their members. Such are those whose members are connected by conjunctive or disjunctive particles. As, *Virtue furnishes the mind with the truest pleasure in prosperity, and affords it the greatest comfort in adversity*. And, *A wise man is neither elated by prosperity, nor depressed by adversity*. And the like may be said of those where the latter member begins with some illative or redditive particle. As in these instances: *The chief thing to be regarded in life is virtue, for all other things are vain and uncertain*. And, *Though fortune is always inconstant, yet she has many votaries*. Neither of the members in any of these ways of expression, and

Elocution. and some others which might be named, can be included one in the other. In all the examples hitherto given, the sentences consist only of simple members; and indeed compound members are not so often inverted, nor included one in another, by reason of their length. However, we shall here produce one instance of each: *Whoever considers the uncertainty of human affairs, and how frequently the greatest hopes are frustrated; he will see just reason to be always on his guard, and not place too much dependence upon things so precarious.* This sentence consists of two compound members, which here stand in their natural order, but may be thus inverted: *He will see just reason to be always on his guard, and not place too much dependence on things so precarious; whoever considers the uncertainty of human affairs, and how often the greatest hopes are frustrated.* In the following sentence one compound member is included in another: *Let us not conclude while dangers are at a distance, and do not immediately approach us, that we are secure; unless we use all necessary precaution to prevent them.* Here the natural order would be: *While dangers are at a distance, and do not immediately approach us; let us not conclude that we are secure, unless we use all necessary precaution to prevent them.*

But there are some other considerations relating to order, which, being taken from the nature of things, equally suit all languages. So, in amplifying, there should be a constant gradation from a less to a greater; as when Cicero says, *Ambition creates hatred, shyness, discords, seditions, and wars.* On the contrary, in extenuating, we should descend from a greater to a less; as if, speaking of the ancient laws of Rome, one should say, *They were so far from suffering a Roman citizen to be put to death, that they would not allow him to be whipt, or even to be bound.* In constituting any whole, we put the parts first; as, *Invention, disposition, elocution, and pronunciation, make up the art of oratory.* But in separating any whole, the parts follow: as, *The art of oratory may be divided into these four parts; invention, disposition, elocution, and pronunciation.* In every enumeration care must be taken not to mix the whole with the parts; but if it be mentioned at all, it must either be put first or last. So it would be wrong to say, *He was a man of the greatest prudence, virtue, justice, and modesty:* for the word *virtue* here contains in it the other three, and therefore should not be inserted among them. See LANGUAGE, N° 17.

§ 3. *Of Juncture and Number.*

Quintilian, speaking of composition, represents a discourse as very happy in that respect, when the *order*, *juncture*, and *number*, are all just and proper. The first of these, which gives rules for the due placing of the words and members of a sentence, has been already explained. We now proceed to the other two, which relate to letters and syllables; the former treating of their connection, and the latter of their quantity.

49 The nature and use of *juncture* explained and illustrated.

I. As to *juncture*. A due attention is to be paid to the nature of the vowels, consonants, and syllables in the connection of words, with regard to the sound.

As to the *first*, when a word ends with a vowel, and the next begins either with a different vowel, or the same repeated, it usually renders the pronunciation hollow and unpleasant. For, as Quintilian has justly observed, "This makes a chasm in the sentence, and stops the course of it." For there must be some pause, in order to pronounce them both, or otherwise the sound of one will be lost. So, for instance, in pronouncing these words, *the other day*, unless you stop a little after the word *the*, the sound of *e* will not be heard; and if it is dropt, it will occasion a rougher sound, from the aspiration of *th* twice repeated so near together, as *th'other day*. Therefore to prevent both these inconveniences, we usually say, *t'other day*. But the different consonants, which together with the vowels make up those syllables, often cause a considerable difference in the pronunciation, so as to render it more or less agreeable. As, if we say, *he overdid it*, the words *he over* have not so harsh a sound as *the other*; though still they require some pause to keep them distinct. Besides, some vowels meet more amicably, and admit of a softer pronunciation than others. Those which have the weakest and smallest sound, follow best; because they occasion the least alteration of the organ in forming the two sounds. Such are *e* and *i*; and therefore, without any chasm in the sound, or hesitation of the voice, we say *he is*. But where the action of the organs is greater, and the sound stronger, the pronunciation is more difficult: as when we say, *tho' all*. For here is a contrary motion of the lips, which are first put forward in sounding the *o*, and then drawn backward to pronounce the *a*; and therefore the sound is much softer to say, *tho' every*, where their action is less. And the like ill effect commonly happens from the repetition of the same vowel: as if we say, *go on*, or, *usually act thus*. There is a considerable difference between these two expressions, in repeating the sound of the vowel, and where either of them is doubled in a single word. For then the same sound only is protracted by one continued motion of the organ; as in the words *good*, and *deem*. But here the sound is repeated again by a new action of the organ; which, if precipitated, obscures the sound of one of the vowels; and, if too much retarded, makes a chasm in the pronunciation; either of which is unpleasant to the ear.

But as the coalition of two vowels occasions an hollow and obscure sound, so the meeting of some consonants renders it very harsh and rough. Thus the words *king Xerxes*, and *public good*, when so placed have not only a roughness, but likewise a difficulty in their pronunciation, from the contrary action of the lips; which in the former are first drawn back and then forwards, but in the latter the contrary way; and in both of them with some considerable force. But this may very easily be avoided, by saying, with a little alteration in the words, *Xerxes, the king*, and *the good of the public*. So likewise the words *ill company*, have a softer sound than *bad company*, for the same reason. To multiply instances of this kind seems unnecessary, which so frequently occur in all discourses.

The repetition of the same syllable at the end and beginning of words, is the last thing to be considered. And a little observation will convince us, that where this happens, it generally renders the sound either confused or unpleasant. Cicero was often rallied on account of this verse:

O fortunatam natam me consule Romam.

Every one will easily perceive a disagreeable sound in the

Elocution. the following expression: "A man many times does that unadvisedly, of which he afterwards repents." The chime of the words *man many* both seems affected, and displeases the ear. But this will soon be remedied, if we separate these two words, and say, "A man does that many times unadvisedly."

From the short account here given of this part of composition, it is easy to perceive what things are necessary to render it most complete and accurate; which are these following. If a word end with a vowel, the next ought to begin with a consonant, or such a vowel whose sound may agree well with the former. But if a word conclude with a consonant, either a vowel should follow, or such a consonant whose pronunciation will suit with it. And lastly, the same syllable ought not to be repeated at the end of one word, and the beginning of the next. It has been observed by some critics, that the following verse at the beginning of Virgil's Æneid has all these properties:

Arma virumque cano, Trojæ qui primus ab oris.

Where any word in this verse ends with a vowel, the next begins with a consonant; and where any one ends with a consonant, the next begins with a vowel; and there is no repetition of the same sound throughout the whole. But this is what rarely happens, especially in our language, which abounds with consonants. And what Quintilian says of the coalition of vowels, in treating upon this subject, seems applicable to the whole. "This (says he) is a thing not much to be dreaded; and I know not whether the neglect of it, or too great a concern about it, be worse. It necessarily checks the vigour of the mind, and diverts it from matters of greater importance. And therefore as it shows negligence to permit it, so to be in constant fear of it discovers a low genius." This was the opinion of that judicious writer. And as these things cannot always be attended to, it may be sufficient to avoid them, where they prove very offensive to the ear, and it may be done without some greater inconvenience. So in this sentence, *Honesty is the best policy*, the coalition of *t* and *p* in the two last words *best policy* produces a roughness in their pronunciation; but as the expression is strong, and cannot perhaps be well altered for the better, the sound here ought to give way to the sense.

50 The nature and use of *number*.

II. *Number*. This respects the quantity of syllables, as *Juncture* does their quality. In the Greek and Roman languages every syllable has its distinct quantity; and is either long, short, or common: two or more of which joined together in a certain order make a foot, and a determinate number of these in a different order constitute their several sorts of metre. This variety of sounds gives a much greater harmony to their poetry, than what can arise only from the seat of the accent, and the similitude of sound at the end of two verses, which chiefly regulate our metre. And although their prose was not so confined with regard to feet, either as to the kind or place of them, as their metrical compositions; yet it had a sort of measure, more especially in the rise and cadency of their periods. This they call *rhetorical number*. And accordingly the ancient writers upon this art acquaint us what feet are best suited to the beginning, middle, or conclusion of a sentence. Such rules are not applicable to our language, which has not that accurate distinction of quantity in its syllables. For we are apt to confound accent with quantity, and pronounce those syllables longest on which we lay the accent, though in their nature they are not so. As in the word *admirable*, where none but the first syllable *ad* is pronounced long; though that is only rendered so by position, and the two following are so by nature. And again, in the word *avárice*, we sound the first *a* long for the same reason, and the second short; contrary to the nature of both these vowels. However, we shall offer a few things that may be of some use to modulate our periods and adjust their cadency.

A great number of monosyllables do not stand well together. For as there ought to be a greater distance in the pronunciation between one word and another, than between the syllables of the same word; such pauses, though short, yet, when too frequent, make the sound rough and uneven, and by that means spoil its harmony. And this may seem more necessary to be attended to, because the English language abounds so much with monosyllables. On the contrary, a continuation of many long words makes a sentence move too slow and heavily. And therefore such periods generally run best, which have a proper mixture of words of a different length. Besides, as every word has its accent, which with us stands for quantity, a number either of monosyllables, or long words, coming together, so far abates the harmony, as it lessens the variety.

Again, several words of the same ending do not stand well together, especially where the accent falls upon the same syllable in each of them. For this creates too great a jingle by the similitude of sound; and is apt to displease, from an appearance of affectation. Of this kind is the following sentence: *Nothing is more wélcome, delightsome, or whólesome, than rest to a wearied man.* In such expressions, therefore, if the order of the words cannot well be altered, some other word should be substituted in the room of one of them at least, to diversify the sound. So in the example here given, the sound might be varied by saying, *Nothing is more wélcome, pleásant, or whólesome.*

But to add no more, if a sentence end with a monosyllable, it is apt to hurt the cadency, and disappoint the ear: whereas words of a moderate length carry a greater force with them by the fulness of their sound, and afford the ear what it expected. And there is one sort of monosyllables more especially, which never stand well at the conclusion of a period, though we frequently find them there; and these are the signs of cases. Thus we say, *Avarice is a crime, which wise men are too often guilty of.* But the cadency would doubtless be more agreeable if it was altered thus: *Avarice is a crime, of which wise men are too often gúilty.* Every one must perceive, when the accent falls upon the last syllable in the sentence, as it does if it end with *óf*, the sound is not so pleasant as when it rests upon the preceding syllable in the word *gúilty*. Nor are very long words well suited either to the beginning or conclusion of a period; for they retard the pronunciation at first, and fall too heavy at the end.

Chap. III. *Of Dignity*.

51 The necessity of dignity in an oration.

Dignity consists in the right use of tropes and figures. It is not sufficient for an orator to express himself

Elocution. self with propriety and clearness, or in smooth and harmonious periods; but his language must likewise be suited to the nature and importance of the subject. And therefore, as *elegance* gives rules for the first of these, and *composition* for the second; so does *dignity* for the last of them. It is very evident, that different subjects require a different style and manner of expression; since, as Quintilian says, "What is magnificent in one discourse would be turgid in another; and those expressions which appear low upon a sublime subject, would suit lesser matters: and as in a florid harangue a mean word is remarkable, and like a blemish; so any thing lofty and bright upon a trivial argument is disproportionate, and like a tumour upon an even surface." Now this variety in the manner of expression arises in a great measure from *tropes* and *figures*, which not only enliven and beautify a discourse, but give it likewise force and grandeur; for which reason this part of elocution seems to have been called *dignity*.

Tropes and figures are distinguished from each other in several respects. Tropes mostly affect single words, but figures whole sentences. A trope conveys two ideas to the mind by means of one word; but a figure throws the sentence into a different form from the common and usual manner of expression. Besides, tropes are chiefly designed to represent our thoughts, but figures our passions.

§ 1. *Of Tropes.*

52 Tropes, what. A *trope*, which is a figure of words, has been usually defined to be *the change of a word from its proper signification to some other with advantage, either as to beauty or strength.* The words, *with advantage*, are added in the definition, because a trope ought not to be chosen, unless there is some good reason for using it rather than the proper word. But in what manner, or how far, it can be said of all tropes in general, that they change the proper signification of words, will best appear by considering the nature of each kind of them separately. Now in every trope a reference is had to two things, which occasions two ideas; one of the thing expressed, and another of that thing to which it has a respect, and is supplied by the mind. For all tropes are taken either from things internally related as the whole and a part; or externally, as cause and effect, subject and adjunct; or from some similitude that is found between them; or from a contrariety. The first of these is called *synecdoche*, the second *metonymy*, the third *metaphor*, and the last *irony*. We shall endeavour to illustrate this by examples. When we say, *Hannibal beat the Romans;* the meaning is, that Hannibal and his army did this. So that although in some sense a part may here be said to stand for the whole, which makes it a *synecdoche;* yet, strictly speaking, the word *Hannibal* does not alter its sense, but there is an ellipsis in the expression, Hannibal being put for himself and his army. But if we say, *Cicero should be read by all lovers of eloquence;* here indeed the word *Cicero* appears to be changed from its proper sense, and to signify the books of Cicero; which is a *metonymy*, the author being put for his works; and therefore such expressions need not be deemed elliptical. Again, if any one, speaking of a subtle and crafty man, should say *he is a fox;* the meaning is, he is like a fox; which is a *metaphor;* where the word *fox* retains its proper sense, and denotes that animal, to which the man is compared on account of his craft. Lastly, If a person say to another, *Well done;* meaning that the thing was ill done, the word *well* keeps its own sense; but from the manner of its pronunciation, or some other circumstance attending the expression, it will be evident that the contrary is intended; which is called an *irony*. From these instances it may appear in what latitude we must understand the common definition of a trope, which makes it to consist in the change of a word from its proper sense into some other. But though in reality there are but four kinds of tropes, which are distinguished by so many different respects which things bear one to another; yet as these several respects are found in a variety of subjects, and attended with different circumstances, the names of *tropes* have from hence been greatly multiplied: which, however, may all be referred to some or other of those already mentioned, as will be shown when we come to treat of them in their order. And for distinction sake we shall call the former *primary*, and the latter *secondary, tropes*.

We now proceed to consider the reasons which have occasioned the introduction of tropes. And these, as Quintilian observes, are three; *necessity*, *emphasis*, and *beauty*.

53 Why introduced. 1. Tropes were first introduced from *necessity*, deriving their origin unquestionably in a considerable degree from the barrenness of language, because no language which we know contains a sufficient number of proper words to express all the different conceptions of our minds: but the principal cause of their introduction seems to be that extensive influence which imagination possesses over every kind of speech. The mind considers the same thing various ways; views it in different lights; compares it with other things; and observes their several relations and affections; wherein they agree, and in what they differ. From all which reflections it is furnished with almost an infinite number of ideas; which cannot all of them be distinguished and expressed by proper words, since new ones occur daily. And were this possible, yet would it be impracticable, because the multitude of words must be so vastly great, that the memory could not retain them, nor be able to recal them as occasion required. Tropes have in a good measure redressed both these inconveniences; for by means of them the mind is not burdened with a numberless stock of different words, and yet nothing seems to want a name. Thus sometimes where a word is wanting to express any particular thing, it is clearly enough represented by the name of some other thing, by reason of the similitude between them. At other times, the cause is signified by the effect, the subject by the adjunct; or the contrary. And the whole is often understood by a part, or a part by the whole. And thus by the use of tropes the mind is helped to conceive of something not expressed, from that which is expressed. It is much the same case, as when we have occasion to speak of a person, whose name we are either unacquainted with, or have forgot; for by describing his person, abode, or some other circumstances relating to him, those we converse with as well understand whom we mean, as if we mentioned his name. So the shepherd in Virgil, when

Elocution. when he could not think of the name of Archimedes, describes him by his works:

> And what's his name who form'd the sphere,
> And show'd the seasons of the sliding year?

Besides, it sometimes happens in a discourse, that those things are necessary to be said, which, if expressed in their proper terms, would be offensive; but being clothed with metaphors, may be conveyed to the mind with decency. Thus then the imagination never contemplates any one idea single and alone, but always along with other ideas, which may be called its *accessories*, and which often operate more forcibly upon the mind than the principal idea itself does. In their nature they are often more agreeable, and frequently also more familiar, to our conceptions; or perhaps they remind us of a greater variety of important circumstances. Hence the name of the accessory is often preferred, as e. g. when we want to point out the time in which a state enjoyed its chief reputation, &c. the proper words might do, but the imagination suggests the flourishing period of a plant or tree; and we say "the Roman empire flourished most under Augustus:" Catiline, we say, was the *head* instead of the *leader* of his party, because the head is the principal part of the human figure.

2. A second reason above mentioned for the use of tropes was *emphasis*. Tropes do many times express things with greater force and evidence than can be done by proper words. We receive much the greater part of our knowledge by our senses. And similitudes taken from sensible things, as in metaphors, very much assist the mind in its reflections upon those things which do not come under the cognizance of the senses. For it is certain, that we are sooner or more strongly affected with sensible objects, than with things of which we can have no ideas but from the internal operations of our own minds. Nay, sometimes one bright and lively trope shall convey a fuller and more just idea of a thing than a large periphrasis. So when Virgil calls the Scipios *two thunderbolts of war*, he gives a more lively image of the rapid force and speedy success of their arms, than could have been conveyed by a long description in plain words. And in many cases the tropical use of words is so emphatical, and suited to the idea we design to excite, that in this respect it may be justly esteemed the most proper. So *incensed with anger*, *inflamed with desire*, *fallen into an error*, are all metaphorical expressions, used in a way of similitude; and yet perhaps no proper words can be made use of, which will convey a more lively image of the thing we design to represent by them.

But *beauty* and ornament, as was observed before, have been another cause of the use of tropes. Some subjects require a more florid and elegant dress than others. When we describe or applaud, ornaments of speech and a gaiety of expression are requisite. And it is the business of an orator to entertain his hearers at the same time that he instructs them. Now Cicero, who was an admirable judge of the force and power of eloquence; has observed, that tropical expressions give the mind the greatest delight and entertainment. "I have often wondered (says he) why tropes should give greater pleasure than proper words. I imagine the reason must be, either that there is an appearance of wit in neglecting what is at hand, and making choice of something at a distance; or that the hearer is furnished with a different thought, without being led into a mistake, which affords a very agreeable pleasure; or that a whole similitude is conveyed to the mind by a single word; or that, particularly in the best and most lively metaphor, the image is presented to our sight, which is the quickest of our senses." And therefore he supposes, that "as garments were first invented from necessity, to secure us from the injuries of the weather, but improved afterwards for ornament and distinction; so the poverty of language first introduced tropes, which were afterwards increased for delight." Besides, a variety of expression is pleasing in a discourse. It is many times necessary that the same thing should be repeated; and if this be done in the same words, it will grow tiresome to the hearers, and sink their esteem of the speaker's ability. Therefore, to prevent this, it is proper the expression should be varied, that although the sense be the same, it may give the mind a new pleasure by its different dress.

We come now, in the last place, to lay down some directions proper to be observed in the choice of tropes.

And first, as every trope gives us two ideas; one, of the word expressed; and another, which, by means of that, the mind connects with it; it is necessary, that the relation between these two appear very plain and evident. For an obscure trope is always faulty, unless where some particular reason makes it necessary. And therefore tropes ought not to be too far-fetched, lest that should render them dark. For which reason Cicero says, he should not choose to call any thing destructive to a person's fortune, *the Syrtis of his patrimony*, but rather the *rock of it*; nor the *Charybdis of his estate*, but the *gulf of it*. For those who either did not know that the Syrtes were two quicksands upon the coast of Africa, or that Charybdis was a gulf in the strait of Sicily, both of them very destructive to mariners, would be at a loss to understand the meaning of the metaphor. Besides, metaphors taken from things we have seen, affect the mind more forcibly than those which are taken from such things as we have only heard of. Now there is scarcely any one who has not seen a rock or a gulf; but there are very few persons, comparatively, who have been either at Charybdis or the Syrtes. It is necessary therefore in a good trope, not only that there be a near affinity between the two ideas, but likewise that this affinity be very obvious and generally known, so that the word be no sooner pronounced but both images do immediately present themselves to the mind.

Again, as a trope ought to be very plain and evident, so likewise should it bear a due proportion to the thing it is designed to represent, so as neither to heighten nor diminish the just idea of it. Indeed, sometimes when we speak of things indefinitely, we say too much, lest we should seem to say too little. And this manner of speaking is called an *hyperbole;* which is not uncommon in the sacred writings. So, for instance, Saul and Jonathan are said to be *swifter than eagles, and stronger than lions*. But even in this way of expression a proportion is to be observed. For some very considerable and unusual excess of the thing in its kind is at least designed by it; which, perhaps, cannot, or however is not necessary to be defined. And therefore Quintilian blames Cato for calling the top of a hill a *wart;* because

cause the proportion between the two ideas is nowise adequate. And so on the contrary Aristotle censures Euripides for calling rowing *the empire of the oar*. Poets indeed are allowed a greater liberty in this respect; but an orator should be modest in his expressions, and take care that he neither so heighten nor diminish the natural ideas of things by tropes, as to lead his hearers into mistakes.

But further: as a moderate use of tropes, justly applied, beautifies and enlivens a discourse; so an excess of them causes obscurity, by running into an abstruse allegories and riddles. Tropes are not the common and ordinary dress of our thoughts, but a foreign habit: and therefore he who fills his discourse with a continued series of them, seems to act like one who appears in public in a strange dress: which no man of character would choose to do.

Moreover, as one use of tropes is pleasure and entertainment, we should endeavour to make choice of such as are smooth and easy. But if at any time we think it necessary to use a harsh trope, it is proper to soften it by some precaution. For, as Cicero very handsomely says, *a trope should be modest, since it stands in a place which does not belong to it; for which reason it should seem to come thither by permission, and not by force.* And therefore when he thought it harsh to say, *The death of Cato made the senate an orphan;* he guards the expression by saying, *The death of Cato has (if I may be allowed to say so) rendered the senate an orphan.*

And, to add no more, care should be taken how we transfer tropes from one language into another. For as they are frequently taken not only from natural things, or such notions as are common to the generality of mankind, but likewise from the manners, customs, and occurrences of particular nations; so they may be very plain and obvious to those among whom they took their rise, but altogether unintelligible to others who are unacquainted with the reason of them. It was customary for the Roman soldiers to carry their money in their girdles: hence it was the same thing with them to say, *a person had lost his girdle*, as that *he had lost his money*. And because the Romans wore the *toga*, which was a long gown, in time of peace, and a different garb when engaged in war, their writers sometimes use the word *toga* to signify peace. But as neither of these customs is in use among us, so neither would the tropes suit our language, or be generally understood by us. And even in such tropes as are taken from the common nature of things, languages very much differ. There is a very beautiful trope in the account of St Paul's shipwreck, where it is said, *The ship was caught, and could not bear up into the wind.* The original word, that we translate *bear up*, is αντοφθαλμειν; and properly signifies, *to look or keep its eyes against it;* which is a very strong and lively image, taken from animate beings, and when applied to men, often signifies *to withstand* or *resist;* as, αντοφθαλμειν πολεμιω, *to resist an enemy;* and Plutarch says of Demosthenes, that he could not αντοφθαλμειν τω αργυριω, *look against* or *resist the power of money.* Nothing is more common with Latin writers, than to call men of a public spirit and true patriots, *lumina et ornamenta reipublicæ*, that is, *the lights and ornaments of the state* And we have borrowed from them the use of both these metaphors. But because tropes and figures illustrate and heighten the style, they call them also *lumina orationis*, or *the lights of a discourse*. It sometimes happens, that only the tropical sense of a word is taken from one language into another, and not the proper signification of the same word. So *scrupulus* in Latin properly signifies *a little stone, which getting into the shoe hurts a person as he walks;* hence it is applied to the mind, and used to express *a doubt, or uneasy thought that gives it pain.* We have borrowed this latter sense of the word, but not the former.

Art. I. Primary Tropes.

34 Metaphor, what.

I. *Metaphor.* A metaphor, as usually defined, is, *A trope, which changes words from their proper signification to another different from it, by reason of some similitude between them.* But that a word, when used metaphorically, does not alter its signification, but retains its proper sense, was shown above. However, it may not be amiss to explain this matter more fully, and set it in a clearer light. Every *metaphor*, then, is nothing else but a short similitude. Cicero calls it a *similitude reduced to a single word.* And Quintilian to the same purpose says, that "a metaphor is a short similitude, and differs from it only in this, that the former is compared to the thing we design to express, and the latter is put for it. It is a similitude, when I say of a man, he has acted like a lion; and a metaphor, when I say, he is a lion." Thus far Quintilian. Now in every similitude three things are requisite; two things that are compared together, and a third in which the similitude or likeness between them consists. And therefore, to keep to this example, when Horace calls a Roman soldier *a lion*, if the word *lion* did not retain its proper sense, there could be no similitude; because there would not be two things to be compared together with respect to a third, which is necessary in every similitude, and was designed by this expression. The sense of which is plainly this: *That as a lion seizes his prey with the greatest fierceness, so a Roman soldier with like rage and fury attacked his enemies.* In the same manner, when Cicero calls Piso *the vulture of the province*, his meaning is, that he was like a vulture, or acted in such a manner as a vulture acts, that is, rapaciously. So that the real difference between a metaphor and a similitude consists in this; that a metaphor has not those signs of comparison which are expressed in a similitude. But some persons have run into mistakes in reasoning from tropes of this kind. For they have so argued from metaphorical words, as if all the affections and properties of the things expressed by them might be attributed to those other things to which they are applied, and by that means have strained the comparison (which has usually but one particular view), in order to make it tally in other respects, where there is not that similitude of ideas. We will endeavour to make this evident by another example from Cicero, where he calls Mark Antony *the torch of the state*. The similitude between Antony and a torch lay in this: *That as a torch burns and destroys every thing within its reach, so Antony brought devastation and ruin wherever he came.* Now a torch has not only a property to burn, but also to give light; but the similitude would not hold in this respect, nor was it at all designed. For Cicero never calls a wicked profligate man, as Antony was, *the light of the state;* though he often gives that character to good and virtuous

tuous men, who by their examples do as it were enlighten others, and show them the way to be happy themselves and useful to others. But though metaphors are usually taken from a similitude between two things, as in the instances here mentioned; yet sometimes they are founded in the similitude which two things bear to two others in some particular respect, by means whereof what properly belongs to one of them is transferred to the other: the former of which are called *simple metaphors*, and the latter *analogous*. Hence the rudder of a ship may be called its *reins;* for what the reins are to a horse, that the rudder is to a ship in guiding and directing it. So that here is a double similitude, one between a ship and a horse, and another between the rudder of the former and the reins of the latter; and from the analogy between the use of the rudder to the one and reins to the other, the reins, which belong properly to the horse, are applied to the ship. Again, some metaphors are reciprocal, in which the similitude holds either way. Thus to steer and to govern are used reciprocally both of a ship and a state: the proper expressions being, *to steer a ship, and govern a state;* and the contrary metaphorical. But though we say, *the foot of a mountain*, borrowing the similitude from animals; yet we do not say, on the contrary, *the bottom of an animal*, meaning his feet; and therefore that metaphor is not reciprocal. From this account therefore of the nature of a metaphor, it may be said to be, *The application of a word by way of similitude to some other thing than what it properly signifies.* And the plainer this similitude appears, the greater beauty there is in the trope.

The use of metaphors is very extensive, as large as universal nature. For there are scarce any two things which have not some similitude between them However, they may all be reduced to four kinds; which was the second thing proposed to be considered.

The first kind of metaphors therefore may be taken from similitudes between animate beings. As where those things, which properly relate to brutes, are accommodated to men; or those which belong to men are applied to brutes. Of the former sort is that joke of Cicero: *My brother being asked by Philip, why he barked so?* answered, *Because he saw a thief.* Here *barking*, the property of a dog, is applied to a man: And the reply does not seem to carry more severity or harshness with it than the question. By the latter sort we say, *a crafty fox*, and *a generous horse;* which are affections that properly relate to men. And to this kind of metaphors may those likewise be referred, when that which properly belongs to the senses is applied to the mind. Thus we often say, *that we see a thing*, when we mean *that we understand* or *apprehend it.* And in the same sense we say, *that we hear such a thing*, or *person.* And by the like manner of expression, a person is said *to smell out a thing.* And those who have a genius or disposition for any art or science, are said *to have a taste for it;* and such as have entered upon the study of it, are said *to have a touch of it.* These are common ways of speaking in most languages, and very expressive of what is intended by them. And we may also bring those metaphors under this head, by which the properties and affections of men are attributed to the Deity: as, when God is said *to hear*, *see*, *be angry*, *repent*, and the like; which are forms of expression very frequent in the sacred writings.

A second kind of metaphors lies between inanimate things, whether natural or artificial, which bear some similitude to each other. And this head is very extensive. Thus we say, *floods of fire, and clouds of smoke*, for large quantities. And so likewise, *to inflame an account*, that is, to heighten or increase it; with innumerable others of the like sort. In the two first of these instances, the terms proper to one element are applied to another; and as those elements of fire and water are opposite to each other, they show the extensiveness of this trope, that there are no things in nature so contrary, but may come within the limits of it, and be accommodated to each other in a way of similitude. In the last example, a natural action is applied to what is artificial.

A third sort of metaphors is, when inanimate things are applied to animals, on account of some like properties between them. Thus Homer calls Ajax, *the bulwark of the Greeks*, on account of his valour, which like a wall defended them from the Trojans. And nothing is more common with Cicero, than to brand ill men with the character of being *the pest of the state*, by reason of the mischief which they bring to the public. So likewise he calls Zeno the philosopher *an acute man*, for his great discernment and quick perception of things; fetching the allusion from metals when brought to an edge or a point. As, on the contrary, old Chremes in Terence calls himself a *stone*, for want of apprehension. And we say, *a gay person*, and *a bright genius*, by this kind of metaphor.

The fourth and last kind of metaphors is that by which the actions and other attributes of animals are accommodated to inanimate things. Thus Cicero, speaking of Clodius, says: "The very altars, when they saw that monster fall, seemed to move themselves and assert their right against him." Here the words *saw*, *move*, and *assert*, are all metaphors taken from the properties of animals. And Virgil, when he would represent the impetuous force and rapidity of the river Araxes, says, *it disdained a bridge.* And it is a very usual epithet, which Homer gives to words, to call them πτερόεντα, or *winged*, to intimate the swiftness of speech.

Lastly, as to the choice of metaphors, those are esteemed the finest and strongest, which *give life and action to inanimate things.* The reason of which is, because they do as it were invigorate all nature, introduce new forms of beings, and represent their images to the sight, which of all the senses is the quickest, most active, and yet most unwearied. What can be more moving, or in stronger terms express the villany of Clodius, than when Cicero says, "The very altars of the gods seemed to exult at his death." And the same great orator particularly commends those metaphors, for their sprightliness and vivacity, which are taken from the sense of seeing; as when we say *a bright thought*, or *a gay expression.*

However, care must be taken not to venture upon too bold and daring metaphors. Poets indeed claim greater liberty in this respect, whose view is often to amuse, terrify, or delight, by heightening the just and natural images of things. But it is expected the orator should reason coolly, though strongly and forcibly; and not by theatrical representations so transport the mind, as to take it off from reflection, unless perhaps on some particular

cular occasion. And yet, on the other hand, metaphors ought not to sink below the dignity of what they are designed to express; but the idea they convey should at least be equal to the proper word in the place of which they are substituted.

But there is a very great difference in the choice of metaphors, as they are designed either to praise or dispraise. One thing may be compared to another in a great variety of respects. And the same thing may be made to appear either noble or base, virtuous or vicious, by considering it in a different light. Such metaphors, therefore, as are chosen to commend, must be taken from great and laudable things; and on the contrary, those which are designed to discommend, from things vile and contemptible. Aristotle gives us a very pleasant example of this in the poet Simonides. A certain person, who had carried the prize at a race of mules, offered him a reward to write a poem in honour of that action. Simonides thought he did not bid high enough; and therefore put him off with saying, the subject was too mean to write in praise of mules, which were the offspring of asses. But upon his being offered a larger sum, he undertook the task; and, as Aristotle observes, when he has occasion to speak of the mules in that poem, he does not mention them by that name, but calls them *the daughters of fleet and generous horses*, though he might with as much propriety have called them *the daughters of dull asses*. But it was the poet's business, in praising, to take the most advantageous part of the character. Where things are capable of such different turns, metaphorical expressions are generally most beautiful. And sometimes the same metaphor may be applied contrary ways, both in praise and dispraise, as it will suit different properties of the thing to which it refers. So a *dove*, in a metaphorical sense, may represent either *innocence* or *fear;* and an *iron heart*, may denote either *courage* or *cruelty;* as a *hard head, strength* or *weakness of thought*. And this ambiguity in the application of metaphorical words often affords occasion for jests and concise wit. We observed before, that Cicero never calls ill men *lights of the state*. But he once in this manner calls Sextius Clodius *the light of the senate*. For when his kinsman Publius Clodius had been killed by Milo, and his corpse was brought to Rome, Sextius raised the mob, and in a tumultuous manner carried it into the senate house, where they burnt it, and by that means set the building on fire: For which seditious act Cicero passes that joke upon him, under the metaphor of light, which elsewhere he always uses in a good sense.

But to proceed: All forced and harsh metaphors should be avoided; the one being no less disagreeable to the mind than the other to the ear. Nor should they come too thick in a discourse. In a word, they ought not to be used, but either where a proper word is wanting, or they are more significant or beautiful than the proper word.

55 Metonymy defined and explained.

II. *Metonymy*. This, as defined by Quintilian, is, *the putting one word for another*. But Vossius describes it more fully, when he calls it, "A trope, which changes the name of things that are naturally united, but in such a manner as that the one is not of the essence of the other." That a metonymy is thus distinguished from the other tropes, has been sufficiently shown already in the two last chapters. When it is said, *to put one word for another*, or, *to change the names of things*, the meaning is, that the word so used changes its sense, and denotes something different from its proper signification. Thus, when *Mars* is put for *war*, and *Ceres* for *corn*, they lose their personal sense, and stand for the effects of which those deities were said to be the cause. So likewise, when Virgil says,

He drank the frothing bowl,

the word *bowl* must necessarily signify the liquor in the bowl. And when in another place, describing the temple of Juno at Carthage, in which the actions of the Trojan war were represented, and the images of the heroes, he makes Æneas, upon discovering that of Priam among the rest, cry out,

Lo here is Priam;

it is plain the word *Priam* there must stand not for his person, but his *image* or *figure*. And this property of changing the sense of the word appears peculiar to metonymy. In treating upon a metaphor, we observed the mistake of those who teach, that a word used metaphorically loses its proper signification; whereas it only changes its place, but not its sense; being applied to a thing to which it does naturally belong, by way of similitude. And as the not attending to this has run some persons into very great absurdities, in treating upon metaphorical expressions, and reasoning from them in the tropical sense; so the like has happened to others in some instances of a metonymy, where, by misapprehending their true nature, they have reasoned from them in the literal sense, as we shall show presently. A metonymy is not so extensive as a metaphor, nor altogether so necessary; because nothing is said by a metonymy, which cannot be expressed in proper words; whereas metaphors are often used for want of proper words to express some ideas. However, metonymies are very useful in language; for they enrich a discourse with an agreeable variety, and give both force and beauty to an expression. And what we observed with relation to a metaphor, is true also of this trope: that some metonymies, even in common discourse, are more frequently made use of than the proper words in whose room they are put. So, *pale death*, *a blind way*, and *a happy state*, are very common expressions with us. And it is more usual to say, *This is such a person's hand*, or *I know his hand*, than his writing, when we intend this latter sense of the word.

We now proceed to the division of metonymies; which are commonly distinguished into four kinds, from the different manner in which things are naturally, but externally, united to one another. Now things are thus united, or one thing depends upon another, either with respect to its production, or in the manner of its existence when produced. In the former way the effect depends upon its cause, and in the latter the adjunct upon its subjects. And hence arise four sorts of metonymies, which receive their names from the *cause* and *effect*, the *subject* and the *adjunct*.

It is called a *metonymy* of the *cause*, when the external cause is put for the effect. The external cause is twofold, the agent and end, which are usually called the *efficient* and *final cause*. Of the former kind are such metonymies, where the inventor or author is put for what was invented or effected by him. Thus, as we we said before, *Ceres* is sometimes put for *corn*, the use of which she was said first to have introduced; and *Mars* for *war*, over which he was thought to preside. And by this way of speaking, any artist or writer is put for his work. So Juvenal, blaming the luxury and profuseness of the Romans, says, *There are few tables without Mentor:* that is, which were not made by him, or after his manner. And our Saviour says, in the parable of the rich man and Lazarus, *They have Moses and the Prophets*, meaning the books of Moses and the prophets. But under this sort of metonymy is included not only the agent, strictly so called, but also any means or instruments made use of in the doing of a thing, when put for the thing done. Thus, *polite literature*, is called *humanity*, because it cultivates and improves the human mind. And in that expression of Cicero, *Words move nobody but him who understands the tongue;* the word *tongue*, which is the instrument of speech, is put for *speech* or *language*. And in the like sense, *arms* are sometimes put for *war*, and the *sword* for *slaughter*. By the same kind of metonymy likewise any affection or quality is put for its effect. As when it is said, *the end of government is to maintain justice;* that is, *such mutual offices among men as are the effects of justice*. And so likewise in that of Cicero, *It is the business of magistrates to check the levity of the multitude*, by which he means tumults occasioned by their levity. Moreover, as human affections are attributed to the Deity in a metaphorical sense, so several parts of the human body are likewise ascribed to him by this kind of metonymy. Thus, his *hand* and his *arm* are used to express his power, as his *ear* and *eye*, his *care* and *providence*, these being the instruments of such effects in mankind. Metonymies of the final cause are those by which the end in doing a thing is put for the thing done. As when we say, *The watch is set*, meaning the *watchmen*, who are appointed for that purpose. And so likewise that expression, *to make an example*, as it signifies, *to punish*, in order to deter others from the like crimes by such an example. As also that of Virgil,

Phillis should garlands crop:

by which are meant *flowers* to make garlands.

The second kind of metonymy puts the effect for the efficient cause, whether the agent, or only the means and instrument. So Virgil calls the two Scipios *the destruction of Libya*, because they were the agents who effected it. And Horace compliments his patron Mæcenas with the titles of being *his guard and honour*; that is, his guardian, and the author of his honour. But when Cicero tells the citizens of Rome, that *the death of Clodius was their safety*, he means the occasion only of their safety. And elsewhere he calls that a *dark hope* and *blind expectation*, the effect of which was dubious and uncertain to those who entertained it. And in like manner, the sons of the prophets, when they were eating the pottage which Elisha had ordered to be set before them, cried out, *There is death in the pot;* that is, some *deadly thing*, as is presently after explained. And thus sweat, which is the effect of labour, is sometimes put for labour. As in the threat denounced against Adam, *In the sweat of thy face shalt thou eat bread*, that is, by labour in cultivating the ground. And, in allusion to this way of speaking, Antony the orator tells Crassus, the improvement of the style by constant exercise, as he prescribed, was a thing of much sweat." And *virtue is said to be gained by sweat*, that is, continued care and exercise in subduing the passions, and bringing them to a proper regulation. But in these two expressions there is likewise a metaphor, the effect of bodily labour being applied to that of the mind. In all these instances the effect is put for the efficient cause.

The third kind of metonymy is, when the subject is put for the adjunct. By subject here, in a large sense of the word, may be understood that wherein some other thing is contained, or about which it is conversant; as likewise the possessor with respect to the thing he possesses; and the thing signified, when put for the sign of it. Now, by the first of these ways of speaking, the seat of any faculty or affection is used for the faculty or affection itself. So it is usual to say, *a man of a clear head*, when we mean a clear mind or understanding; the seat of the mind being supposed to be in the head. And a person is said *to have a warm heart*, because the heart has been thought the seat of the affections. In like manner, the place where any actions are performed is put for the actions done in it. As when Cicero says, "Do not always think of the forum, the benches, the rostra, and the senate;" meaning the discourses which were usually made in those places. So likewise the country, or place of residence, is put for the inhabitants, as in that passage of Cicero: "And to omit Greece, which always claimed the pre-eminence for eloquence, and Athens, the inventress of all sciences, where the art of speaking was invented and perfected; in this city of ours, (meaning Rome), no studies have prevailed more than that of eloquence:" where the words Greece and Athens stand to denote the inhabitants of those places. And hither may also be referred those expressions in which the time is put for the persons living in it; as *the degeneracy of the present age, the virtue of former times*. In the second way above mentioned, the object is used for the person or thing employed about it: As when Cicero says, "In time of battle the laws are silent; where by *laws* he intends the *judges*, who pronounce sentence according to law. By the third of these ways, in which the possessor is put for the thing he possesses, we say, *to devour, destroy*, or *ruin a man*, meaning not his *person* but his *estate*. And mythologists explain the fable of Actæon by this trope, who is said to have been devoured by his dogs; for by dogs they understand flatterers and parasites, who consumed his estate and brought him to beggary. By the last way before recited, which puts the thing signified for the sign, statues and pictures are called by the names of the persons which they represent: as in that jest of Cicero upon his brother Quintus, when, as Macrobius relates, "being in the province which his brother had governed, and seeing a large portrait of part of his body, holding a shield, though Quintus was but a little man, he said, My half brother is bigger than my whole brother." The Popish doctrine of transubstantiation is founded upon an abuse of this trope. For when our Saviour, speaking of the bread and wine at that time before him, says, "This is my body, and this is my blood," his plain meaning is, they were the signs of his body and blood, the thing signified being put for the sign by this sort of metonymy. But the Papists take the expression literally, which must doubtless be very absurd:

absurd: since the words relate to the time then present, while Christ was yet living, and spoke them; when it was impossible for the bread and wine to be converted into his body and blood, it being evident to all who were present, that those elements, and his body, existed separately at the same time. But if the words are explained by this trope, the sense is plain and easy, and the way of speaking familiar to all writers. Whereas they who plead for the literal sense might with equal reason assert that those expressions above mentioned are to be taken literally, in which several parts of the human body, as the hand, the arm, the ear, and the eye, are ascribed to the Deity; or that, when our Saviour in a metaphorical sense calls himself *a vine*, and *a door*, these words were designed to be applied to him strictly and properly, and not by way of similitude only, as is the case in all metaphors.

The fourth kind of metonymy is that wherein the adjunct is put for the subject, which is done in the same variety of ways as the former. It is therefore a metonymy of the adjunct, when the thing contained is put for that which contains it. As when Virgil says, "They lie down upon purple;" that is, upon couches dyed with purple. And again, "They crown the wine;" meaning the bowl which contained the wine, it being the custom of the ancients to deck their bowls with garlands at their entertaiments. By these tropes likewise virtues and vices are put for the persons in whom they are found. As in that beautiful passage of Cicero, where, comparing the profligate army of Catiline with the forces of the state, he says, "On this side modesty is engaged, on that impudence; on this chastity, on that lewdness; on this integrity, on that deceit; on this piety, on that profaneness; on this constancy, on that fury; on this honour, on that baseness; on this moderation, on that unbridled passion; in a word, equity, temperance, fortitude, prudence, and all virtues, engage with injustice, luxury, cowardice, rashness, and all vices." And to this trope those expressions are to be referred, in which any thing is put for the object about which it is conversant. As in that saying of the wise man, "Hope deferred makes the heart sick;" where hope is put for the thing hoped for. And thus Suetonius calls the emperor Titus *the love and delight of mankind*, whose mild and obliging temper rendered him the object of those agreeable affections to all persons under his government. A third use of this trope is putting a thing for the time in which it was done. Thus we say of a person, *he has served so many campaigns*, meaning so many summers, that being the usual time in which armies are drawn out into the field. Lastly, by this metonymy, the sign is put for the thing it signifies; as, *the sceptre* for *the regal dignity*, and *the sword* for *the authority of the magistrate*.

56 Synecdoche explained.

III. *Synecdoche*. This is a trope by which either the whole of a thing is put for a part of it, or a part for the whole, so that the two things, whose ideas are presented to the mind in this trope, are internally related to each other: by which, as has been shown already, it is distinguished from all the other tropes. In a *synecdoche* the word retains its proper sense, and the expression is elliptical, as will appear by the several species of it, wherein the ellipsis in most of the examples is very obvious, and may with no great difficulty be supplied. Now a thing may be considered as a whole in three different respects, which logicians call an *universal*, *essential*, *and integral whole*. An universal whole is any genus with regard to its several species: as, an *animal* with respect to *mankind* and *brutes*, or *philosophy* with respect to the several *arts* and *sciences* comprised under it. An essential whole consists of matter and form; as, a *man* of *body* and *soul*. And an integral whole is any body or quantity, with respect to the several parts of which the matter of it is composed, and into which it may be divided: as, an *human body* with respect to its *several members*; or a *year*, as divisible into *months*, *weeks*, and *days*. And thus rhetoric is an integral whole in respect to the four parts that compose it; namely, invention, disposition, elocution, and pronunciation. So likewise any aggregate body, as a civil community, which is divisible into those who govern and are governed; or any army, consisting of the general and his soldiers. As a whole therefore, in each of these acceptations of the word, is frequently put for a part, and a part for the whole; hence arise six species or sorts of synecdoche.

The first of these puts the genus for the species.—Thus, virtue in general is sometimes used to denote some particular sort of virtue. As when Cicero mentions virtue as one of the four qualifications necessary in a general, he means greatness of mind. And so persons are often commended for instances of virtue shown in their conduct, which respect only some single virtue, as justice, temperance, or the like: And in this sense Cicero calls Clodius *a deadly animal*. So when our Saviour commissions his apostles to *preach the gospel to every creature*, the meaning is, *every rational creature*. And thus, likewise, *to talk to a person* sometimes denotes the same thing as to *blame* him, which is one way of talking.

The second kind of synecdoche puts the species for the genus. Thus *bread* denotes any kind of food; as when a person is said *to get his bread by his labour*. In the same way of speaking, *money* is put for any kind of wealth in general. And it is an usual expression to say, that *wine destroys more than the sword*; that is, than any *hostile arms*. And the legal form of banishment among the Romans was, to prohibit persons *the use of fire and water*; that is, *the most common and ordinary necessaries of life*, in which all others were included.

The third species of this trope is, when the essential whole is put for one of its parts; that is, either for the matter or form. Thus, in the evangelist, Mary Magdalen says, *They have taken away my Lord, and I know not where they have laid him*, meaning his *body*.—So it is usual to say of a deceased person, *He was buried at such a time*. And in the inscriptions of sepulchral monuments we frequently meet with this expression, *Here lies such a one*; that is, his *corpse*. Nor are instances uncommon in which the whole being is put for the form. Thus when Cicero says, *Those persons live, who have fled from the confinement of the body, as from a prison*; by *persons* must necessarily be understood their *souls*, which are here distinguished from and set in opposition to their *bodies*. And so Virgil represents Æneas as meeting with Dido and some of his Trojan friends in the infernal regions; by which are meant their *ghosts*.

The fourth kind of synecdoche is, when either the matter or form is put for the whole being. Thus *silver* and

Elocution.

and *gold* are used to signify money made of those metals; as when we say, *I have so much silver*, or *so much gold*. And the word *soul*, both in our own and other languages, is put for the *whole person*. So with us, *a merry soul*, and *a dull soul;* in Cicero, *dear souls;* and in Horace, *candid souls*, are all used in this tropical sense. But this way of speaking occurs nowhere more frequently than in the Sacred Writings. Thus, for instance, it is said, *All the souls which came with Jacob into Egypt*, meaning the *persons*. And again, *The soul that sinneth it shall die;* from which expression, and others of the like import, some persons, by not attending to the nature of this trope, have been erroneously led to infer that the soul is naturally mortal. But sometimes only part of the matter stands to express the whole essence or being. So we imitate the Latins in using the word *caput* or *head* to denote either a *person* or *thing*. For, as with them *lepidum caput*, so with us *a witty head*, signifies the same as *a man of wit*. And in the same sense, *so many head of cattle* means so *many entire cattle*.

By the fifth sort of synecdoche, the whole of any material thing or quantity, whether continued or discrete, is put for a part of it. So when Cicero says, *A war is kindled through the whole world*, in compliment to his country, he calls the Roman empire *the world*. And this expression is also used by historians. Thus Cornelius Nepos, speaking of the quarrel between Mark Antony and Augustus, tells us, *that each of them desired to be lord of the world*. And in like manner St Luke says, *There went out a decree from Cæsar Augustus, that all the world should be taxed.* So in St Paul's shipwreck, it is said, *They ran the ship aground*, that is, *the head of her*, for it is plain by what follows, that the stern was loose. And as to discrete quantity, our Saviour, using this trope, said he should be *three days and three nights in the heart of the earth.* Though he did not continue three whole days and nights in the grave, but only part of the first and third day, and the whole second day, with the two whole nights between the first and third day, according to our way of reckoning. For he was buried on Friday in the afternoon, and rested in the grave that night, with the following day, which was the Jewish Sabbath, and was risen on the morning of the next day. So that we must necessarily have recourse to this synecdoche which puts the whole for the part, to clear up that event.

By this kind of synecdoche, also, the plural number is sometimes put for the singular. Thus St Matthew says, *The thieves who were crucified with our Saviour reviled him:* though it is plain from St Luke, that only one of them did so. It may also be referred to this trope, when a certain number is put for an uncertain one. So it is an usual way of expression to say, *I have seen or done such a thing an hundred or a thousand times:* when perhaps so many are not really intended, but only in general some considerable number.

The sixth and last kind of synecdoche puts a part of any material thing or quantity for the whole of it. So we say of a man, *He shelters himself under such an one's roof;* that is, *in his house*. And of a fleet, that it *consists of so many sail;* meaning, *so many ships*. And by this trope, that is ascribed to a single person which was done by the assistance of others, and in conjunction with them: As when it is said, that *Hannibal killed forty thousand Romans at the battle of Cannæ;* For an army is an aggregate body, of which the general is the head, and consequently the chief part of it. And to this kind of synecdoche may also be referred such expressions in which the singular number is put for the plural: as if one should say, *A man is liable to be misled by the influence of irregular passions;* meaning *all men*, or *mankind in general*. Or when less than the real number is put for any round number: Thus some ancient writers, when they speak of the Grecian armada that came against Troy, call it a fleet of a *thousand ships;* though according to Homer's list, it contained 1186. And so likewise the Greek interpreters of the Old Testament are usually called the *Seventy;* whereas, in reality, they were seventy-two.

57 Irony defined and illustrated.

IV. *Irony*. This is *a trope in which one contrary is signified by another:* As if any one should say, *Well done;* when at the same time his design is to intimate that the thing was *ill done*. So that, by this manner of expression, the speaker appears to mean something contrary to the sense of the word he makes use of. Not that the word is changed from its usual signification; but by the circumstances attending the expression, we perceive the contrary to what is spoken is intended. Quintilian observes, that an irony may be known one of these three ways: "By the manner of pronunciation, or from the nature of the person or the thing. For (as he adds) where any of these does not suit with the words, it is plain the speaker intends the contrary. The irony is very plain from the manner of pronunciation in that passage of Terence, where Simo speaking to his servant by way of reproof, says, "You have taken great care indeed." From the circumstances of the person, when Cicero, addressing to Catiline, says, "He went to your companion, that *excellent man*, Marcus Marcellus." When he calls him an *excellent man*, it is evident he means the contrary: because no good man would be a companion of Catiline. And when he begins his oration for Ligarius with saying, "Cæsar, this is a *new* crime, and never heard of till now," the thing he is speaking of shows it to be an irony; for it was not new, as all who were present very well understood.

The subjects of irony are vices and follies of all kinds. And this way of exposing them is often more effectual than serious reasoning: For many persons, who, either from temper or want of reflection, cannot be moved by the force of an argument, are not proof against the poignancy of wit and raillery. And therefore we find the most grave and serious persons have not declined the use of this trope upon proper occasions. Socrates, whom the oracle pronounced the wisest man of his age, gave so much into it, that he got the name of *ειρων*, that is, the *droll*. In the Sacred Writings we have a remarkable instance of it in the prophet Elijah, where he challenges the priests of Baal to prove the truth of their deity: For it is said expressly, "He mocked them, and said, Cry aloud, for he is a god; either he is talking, or he is pursuing, or he is on a journey, or peradventure he sleepeth, and must be awaked." And Solomon takes the like method to expose the follies of youth by this ironical apostrophe, "Rejoice, O young man, in thy youth," with what

what follows, which is all ironical. Nay, our Saviour himself thought fit thus to reprove the Jewish doctors, when he says, "Full well ye reject the commandment of God, that ye may keep your own tradition:" Where, by the words *full well*, or, as it is in the original, καλως, it is very evident that a severe reprimand was intended.

An irony is used on a variety of occasions, as we shall show from some instances in Cicero. Sometimes he applies it in a way of jest and banter: As when he says, "We have much reason to believe the modest man would not ask him for his debt, when he pursues his life." At other times by way of insult and derision: Thus when he would represent the forces of Catiline as mean and contemptible, "O terrible war, (says he), in which this band of rakes are to march under Catiline! Draw out all your garrisons against this formidable body." Again, at other times, to give the greater force to his argument, he would seem, as it were, by this trope to recal and correct what he had said before; as in his oration for Milo: "But it is foolish in us to compare Drusus, Africanus, Pompey, and ourselves, with Clodius; all our calamities were tolerable, but no one can patiently bear the death of Clodius." Now the character of Clodius was so well known, that all who were present must be sensible he meant the contrary. And, to name no more, an irony is never used to greater advantage, than when it is followed immediately by something very stinging. Thus, speaking of Piso, he says, "You have heard this philosopher: he denies that he was ever desirous of a triumph." And then addressing himself to him, he immediately adds, "O wretch! when you destroyed the senate, sold its authority, subjected your consulate to the tribune, overturned the state, betrayed my life and safety for the reward of a province; if you did not desire a triumph, what can you pretend you did not desire?" This must effectually confound the false gravity at that time assumed by Piso.

Art. II. Secondary Tropes.

58 Secondary tropes similar in nature, though not in name, to the former ones.

Secondary tropes are so called, because they are all of the same nature with the former, and may be referred to some or other of them, though they have received different names.

They are chiefly eight in number; *Antonomasia*, *Communication*, *Litotes*, *Euphemism*, *Catachresis*, *Hyperbole*, *Metalepsis*, and *Allegory*. The three first of these are simple tropes, and may all be referred to a *Synecdoche*. But the five last are of a mixed or complex nature, and not confined to any one of the primary tropes; as will appear in treating upon them in order.

59 A common word often used by way of eminence for any thing remarkable.

I. A common or general word is sometimes used for the proper name of some particular thing or person which upon any account is eminent and remarkable. So we say, *He is gone to the city*, or *he came from the city*, that is, *London*. And by the *Scriptures*, we mean the *Bible*. So likewise, in speaking of persons, *the orator* is used for Cicero, *the poet* for Homer or Virgil, and *the philosopher* for Aristotle: and it is not unusual to say *the apostle*, when we mean St Paul. On the contrary, the proper names of things or persons are sometimes applied to any other of the same character. Thus we use the word *gospel* for any certain and undoubted truth. And *Carthaginian faith* proverbially stood for the greatest falsehood and deceit among the Romans. With the Greeks, *Hercules* signified a *strong man*, *Nestor* a *wise man*, and *Irus* a *beggar*; and the names of *Samson*, *Solomon*, and *Job*, now answer the like characters. Both these ways of expression are often very emphatical, and heighten the idea more than where things are expressed by their own name. To call a good orator *Cicero*, or an excellent poet a *second Virgil*, includes not only an encomium upon the arts themselves, but leads the mind to what is most perfect in them, and was peculiar to those persons. These forms of speech are called *antonomasia*, and come properly under a synecdoche; for in the former the whole is put for a part, and in the latter a part for the whole.

60 A change of persons common in oratory.

II. Nothing is more common with orators than a change of persons. Sometimes, to avoid envy, and prevent the imputation of pride, in assuming to themselves the praise of any laudable action, they ascribe it to their hearers, and do not say, *we*, but *ye did so and so*. At other times, when it is necessary to remind them of something which they have done amiss, or to caution them against some wrong step for the future; to prevent giving offence, they take it upon themselves, or at least join themselves with them, and do not say, *you have done this*, or *do not you do this*: but, *we have done it*, or *let us not do it*. And again, at other times, in compliment to their hearers, they join them as partners in the commendable actions or virtues of other persons; as when the whole body of the people is brought in to share the praise arising from the success of wise counsels or victorious arms. Such ways of speaking often occur both in Demosthenes and Cicero. They are called *communication*, and come properly under a synecdoche of the whole.

61 Litotes, where, by denying the contrary, more is meant than is expressed.

III. On the contrary, there is a mode of speech, in which, by denying the contrary, more is intended than the words express. This way of speaking is called *litotes*: and is often used for sake of modesty where a person is led to say any thing in his own praise, or to soften an expression which in direct terms might sound harsh or give offence. As if one should say, *I do not commend you for that*; meaning, *I greatly discommend*, or *blame you for it*: where more being understood than the words expressly denote, it is properly a synedoche of the part. Not that this manner of speaking is always to be so interpreted; but where it is not, there is no trope; which must be judged of by the circumstances of the discourse. But that it frequently is so used, might be easily shown from many instances; though it will be sufficient to mention two or three. Cicero speaking of Cotta, calls him *no mean orator*, whom he had just called *a very great orator*. And he says of Varro that "he pursued his studies not without industry; and afterwards gives him the character "of a man of the greatest application." Which passages, compared together, plainly show the import of those negative expressions. And a friend of Cicero, writing to him, begins his letter thus: "Although I am sensible the news I send you will not be very pleasant." This news was concerning the death of another friend of Cicero's; and there by the words *not very pleasant*, must, to be sure, be meant *very unpleasant and melancholy*; but he chose that expression in the beginning

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beginning of his letter, as the softest and least shocking, the better to prepare him for the following account of what that news was. And in this way interpreters explain that passage in St Matthew: *And thou Bethlehem in the land of Judah art not the least among the princes of Judah;* where, by *not the least*, they understand the *greatest*, or *very great*, upon account of the honour it received by the birth of our Saviour, as the words immediately following plainly intimate.

62 Ungrateful things softened by agreeable words.

IV. When any displeasing or ungrateful thing is expressed by a more soft and agreeable word, it is called *euphemism*. And as the word made use of is either contrary to the proper word, or only different from it, it may be referred to different tropes. The Latins have a soft way of expressing their disregard to a person, by saying *valeat;* which we have borrowed from them, and say, *fare him well.* When the contrary being intended to what is expressed, it comes properly under an *irony*. And as the word *death* carries in it an idea that is disagreeable to human nature, instead of saying a person is dead, we often say *he is deceased*, or *departed;* which we have also taken from the Latins, who use the words *decessit* and *obiit* in the same sense. So that in both languages it comes under a synecdoche of the whole; to depart out of life being one sort of departure. But when the evangelist, speaking of Stephen, who was stoned to death, expresses it by saying, that *he fell asleep;* this is a beautiful metaphor, taken from the similitude between the death of a good man and sleep.

63 Catachresis or harsh tropes.

V. *Catachresis* signifies in general any harsh trope, though it is most commonly found in metaphors. It is principally used by poets, who make choice of it for novelty, or to enforce an expression, where the proper word does not seem strong enough. As when Milton, in describing the angel Raphael's descent from heaven, says, he

Sails between worlds and worlds;

where the novelty of the word enlivens the image more than if he had said *flies*. But it is sometimes found in the gravest authors, and even in the sacred writings. So we read of the *blood of the grape*. And Solomon says, *the horse-leech hath two daughters*. In all these instances the trope is a metaphor. But when St John says in the Revelations, *I turned to see the voice that spake to me*, it is here a metonymy of the adjunct; the word *voice* being put for the person who uttered it. In St Matthew we read of *Simon the leper;* not that he was then a leper, but had been so, and was cured; which is a *synecdoche* of the part. And when a criminal is said *to have had his reward*, that is, his punishment, it is an *irony*.

64 Hyperbole the boldest of all tropes.

VI. *Hyperbole* is the boldest of all tropes; for it exceeds the strict bounds of truth, and represents things either greater or less, better or worse, than they really are. But the representation is made in such a manner as not to impose on the hearers. For an *hyperbole* is not used to define or describe any thing accurately, but only to magnify or depress it in a considerable degree, when we either cannot or do not choose to represent it exactly. The excess in this trope is called *auxesis;* as when we say of any thing that is very high, *it reaches to the skies*. The defect, or contrary extreme, is termed *meiosis*. So we say of a very lean person, *he is nothing but skin and bones*, or *a mere skeleton*. It is principally metaphorical, but sometimes taken from other tropes. When Saul and Jonathan are said to have been *swifter than eagles, and stronger than lions*, the expression is founded in similitude, and is therefore a metaphor. When, instead of saying Cato was a very virtuous man, the historian calls him *the image of virtue;* it is an hyperbolical metonymy of the adjunct for the subject. And when we read in the Mosaic history *of cities fenced up to heaven*, there is a *synecdoche*. But if a man of weak sight be said *to be eagle-eyed*, it is an *irony*. Those hyperboles which are expressed comparatively, are commonly most emphatical, because they show a peculiarity in the excess. To say a thing is *as light as a feather*, carries the idea very far; but to say *it is lighter*, not only carries it still farther, but also heightens it, by leaving the mind at an uncertainty where to fix the limits.

65 Metalepsis, where two or more tropes are meant under one word.

VII. Sometimes two or more tropes and those of a different kind, are contained under one word; so that several gradations, or intervening senses, come between the word that is expressed, and the thing designed by it. And this is called a *metalepsis*. The contests between Sylla and Marius proved very fatal to the Roman state. Julius Cæsar was then a young man. But Sylla observing his aspiring genius, said of him, "In one Cæsar there are many Mariuses." Now in this expression there is a metalepsis. For the word *Marius*, by a *synecdoche*, or *antonomasia*, is put for any ambitious and turbulent person; and this again, by a *metonymy* of the cause, for the ill effects of such a temper to the public. So that Sylla's meaning, divested of these tropes, was, that Cæsar would prove the most dangerous person to the Roman state that ever was bred in it: which afterwards proved true in the event. So when Virgil, describing that part of the African coast where Æneas arrived with his ships, says, *A dark wood hung over it;* the word *dark*, by a metonymy of the effect, is put for *shady*, and that again by the same trope for *thick;* his meaning is, a *thick wood*. But the words of Dido, in the same poet, contain a larger gradation, when she says,

Happy, ah truly happy, had I been,
If Trojan ships our coasts had never seen.

In which expression first by a metonymy of the adjunct, the ships are put for the Trojans in the ships: and these, by a synecdoche of the whole, for Æneas, who was one of them; and again his arriving on the coast, by a metonymy of the cause, for her seeing him; and lastly, her seeing him, by the same trope, for the passion she had for him. So that her meaning is, she had been happy, if she had never entertained a passion for Æneas. This trope is more frequently to be met with in poets than in orators, as they take greater liberty in using distant allusions than is suited to that perspicuity of expression which is required in oratory. But as Quintilian has well observed, all the intermediate links of the chain in this trope are of no further use than to lead the mind gradually from the first to the last, the better to perceive their connection. As in the example last mentioned, relating to Dido, if we drop all the intervening steps, and connect the words expressed with what is directly intended, they will be found to contain a very remote cause put for the effect, which comes under

Elocution. der a metonymy. On the contrary, in the second example, where *dark* stands for *thick*, the effect is put for a remote cause. And the first, which is founded in a similitude of temper between Cæsar and Marius, belongs to a *metaphor*.

66
Allegory, a continuation of tropes through several sentences.

VIII. *Allegory*. As a metalepsis comprises several tropes in one word, so this is a continuation of several tropes in one or more sentences. Thus Cicero says, "Fortune provided you no field, in which your virtue could run and display itself:" where the words *field* and *run* are metaphors taken from corporeal things, and applied to the mind. And in another passage, speaking of himself, he says, "Nor was I so timerous, that after I had steered the ship of the state through the greatest storms and waves, and brought her safe into port, I should fear the cloud of your forehead, or your colleague's pestilent breath. I saw other winds, I perceived other storms, I did not withdraw from other impending tempests; but exposed myself singly to them for the common safety." Here the state is compared to a ship, and all the things said of it under that image are expressed in metaphors made use of to signify the dangers with which it had been threatened. And indeed allegories generally consist of metaphors; which being the most beautiful trope, a number of them well chosen and put together is one of the finest and brightest ornaments in language, and exceeds a single metaphor in lustre, as a constellation does a separate star. It is true, that allegories are sometimes found in other tropes; but this is very rare. In that known expression of Terence, the tropes are all metonymies: *Without Ceres and Bacchus, Venus grows cold;* that is, divested of the tropes, *Without meat and drink, love dies.* And Samson's riddle is made up of synecdoches: "Out of the eater came forth meat, and out of the strong came forth sweetness." But there is no small skill required in the right management of allegories. For care should be taken that the same kind of trope be carried through the whole, so as to compose one uniform and consistent set of ideas: otherwise they dress up a chimera, a thing that has no existence, and of which the mind can form no perception. And, as Quintilian says very justly, "to begin with a tempest and end with a fire, would be very ridiculous and unnatural." It is likewise very necessary that the allusions be all plain and evident, especially where the name of the thing alluded to is not expressed. These are called *pure allegories*. As that of Cicero: "So it happens, that I, whose business it is to repel the darts, and heal the wounds, am obliged to appear before the adversaries have thrown any dart; and they are allowed a time to attack us, when it will be not in our power to avoid the assault; and if they throw a poisonous dart, which they seem prepared to do, we shall have no opportunity to apply a remedy." The tropes here are all taken from military affairs, without any intimation what they are applied to. But that is plain from the context of the discourse. For he is speaking of the disadvantages he laboured under in defending his client against those of the opposite side, and so applies to the bar those terms which were proper to the field. But where the reference is not evident, it becomes a riddle: which is nothing else but an obscure allegory. To avoid this, therefore, the best writers generally use what they call *mixed allegories*, that is, such wherein the proper name of the thing is expressed, which the whole similitude respects. Of this kind is that in the speech of King Philip of Macedon, given us by Justin, where he says, "I perceive that cloud of a dreadful and bloody war arising in Italy, and a thunder-storm from the west, which will fill all places with a large shower of blood, wherever the tempest of victory shall carry it." The proper words *war*, *blood*, and *victory*, being joined to the tropes *cloud*, *shower*, and *tempest*, in this sentence, render the several parts of the similitude plain and evident. Quintilian thinks those allegories most beautiful, where the whole similitude is expressed, and those words, which in their proper sense relate to one of the two things between which the comparison is made, are allegorically applied to the other: As when Cornelius Nepos says of Atticus, "If that pilot gain the greatest reputation who preserves his ship in a boisterous and rocky sea; ought not he to be thought a man of singular prudence, who arrived in safety through so many and so great civil tempests? These are the allegories with which orators are chiefly concerned.

§ 2. *Of Figures*.

67
The term *figure* apparently borrowed from the stage.

This term seems to have been borrowed from the stage, where the different habits and gestures of the actors, suitable to the several characters they sustained, were by the Greeks called σχηματα, and by the Latins *figuræ*: And it is not unusual with us to say of a person, both with respect to his dress and action, that he makes *a very bad*, or *a very graceful figure*. And as language is the dress, as it were of our thoughts, in which they appear and are represented to others; so any particular manner of speaking, may, in a large sense of the word, be called its *figure*, in which latitude writers sometimes use it. But rhetoricians have restrained the sense of the word to such forms of speech as differ from the more common and ordinary ways of expression: as the theatrical habits of actors, and their deportment on the stage, are different from their usual garb and behaviour at other times. A *figure* therefore, in the sense it is used by rhetoricians, is *A mode of speaking different from, and more beautiful and emphatical than, the ordinary and usual way of expressing the same sense;* or, in other words, *That language which is suggested either by the imagination or the passions.* Now as the habits and gestures of our bodies are in a manner infinitely variable, so it is plain that the different forms of speech are almost innumerable. But every alteration from the common manner ought not to be esteemed a figure, nor deserves that character. It must contain some beauty, or express some passion, to merit a place among rhetorical figures, and be marked out for imitation.

The subject of *figure* seems to have been one of the last things which was brought into the place of oratory, in order to complete it. Aristotle, who treats so accurately upon other parts, says very little of this. But the Greek writers who came after him have abundantly supplied that deficiency. It is to them we owe the chief observations that have been made on this subject. They took notice of the several modes and turns of expression, observed their force and beauty, and gave them particular names by which they might be known and distinguished from each other. And indeed

Elocution. indeed they have treated the matter with such minuteness and subtility, that Quintilian seems, not without reason, to think they have multiplied figures to an excess. But though it was so late before they were taken notice of, and introduced into the art of speaking, yet the use of them in discourse was doubtless very ancient. The author of Homer's life, which some have ascribed to Plutarch, has shown, by examples taken out of him, that there is scarce a figure mentioned by rhetoricians, but is to be met with in that most ancient poet. And, if we consider the nature of speech, we shall easily perceive that mankind must have been under a necessity very early to introduce the use of *tropes* for supplying the want of proper words to express their simple ideas: so the like necessity must have put them upon the use of figures to represent their different passions; though both of them were afterwards increased, and improved in such a manner as to become the chief ornaments of language. The passions of men have been always the same; they are implanted in us by nature, and we are all taught to discover them by the same ways. When the mind is disturbed, we show it by our countenance, by our actions, and by our words. Fear, joy, anger, alter the countenance, and occasion different emotions and gestures of the whole body. And we know with what passion a man is affected, by hearing his words, though we do not see him. He does not express himself as he usually does at other times when cool and sedate. Objects appear to him in a different view, and therefore he cannot but speak of them in a different way. He interrogates, he exclaims, he admires, he appears, he invokes, he threatens, he recals his words, repeats them, and by many other different turns of expression varies his speech no less than his countenance, from his common and ordinary manner. Now as nature seems to teach us by these figurative expressions how to represent the different commotions of our minds, hence some have thought fit to call figures *the language of the passions*. And as these are given us, among other wise ends, to excite us the better to provide for our preservation and safety, this is done sometimes by force of arms, and at other times by discourse. And therefore Cicero very handsomely compares the conduct of an orator to the exercises of the palæstra: in which, as each combatant endeavours not only to defend himself, and attack his adversary, but likewise to do both with decency; so the principal weapons of an orator, as he represents them, are figures, which being no less the ornaments of language than images of our passions, answer all these purposes. Besides, figures chiefly distinguish the different kinds of style, furnish it with an agreeable variety, and often serve to represent things in a clear and forcible manner.

From this short account of the nature of figures, the advantage of them to an orator is very evident. They are a sort of natural eloquence, which every one falls into without attending to it, suitably to that temper of mind with which he is affected himself, and is desirous to affect others. In a cool and sedate discourse, such figures as convey our sentiments with the greatest strength and evidence are most proper. And there are others, which are suited to brighten and enliven more gay and sprightly objects. Others again are more peculiarly adapted to express the disorders and perturbations of the mind. To repeat the same thing again would many times be deemed a tautology and impertinent; but to do this when the mind is ruffled, is not only allowable, but the repetition renders it more strong and affecting. So likewise to interrogate, exclaim, or admire, under the influence of a passion, impresses the hearers, and disposes them to attention; whereas at another time perhaps such ways of speaking would scarce be consistent with prudence. There is a natural sympathy in men's minds, which disposes them to receive impressions from those with whom they converse. Thus one gay and pleasant companion gives a cheerfulness and vivacity to a whole company; whereas, on the contrary, one who is dull and phlegmatic damps the spirits of all about him, and affects them with the same gloomy temper. Figures are peculiarly serviceable to an orator for answering these different intentions. And as he finds them in life, from thence he must copy them; as a painter does the features of the countenance, and the several parts of the body; figures being to the one what lines and colours are to the other. The design of Catiline to destroy the Roman state and burn the city, is a story well known. There was an army drawn together at a proper distance to favour the undertaking; and others were left in Rome, who had their parts assigned them for burning the city, and destroying those who should escape the flames And, in a word, every thing was ready for putting in execution this horrid and barbarous scheme. So that nothing retarded it but the taking off Cicero, who was then consul, which was thought necessary to be done first. Cicero, upon information of the design against his life, finds means to prevent it, and the same day calls together the senate. And Catiline, who was a man of consummate boldness, had the confidence to appear in that assembly. Upon their meeting, Cicero opens to them the whole affair of the conspiracy, and the design against himself, in a most warm and pathetic harangue. In which he had two things in view; to raise the indignation of the senate against the conspirators, and particularly against Catiline; and, either by terrifying or exasperating him, to oblige him to leave the city. Now he does not begin his speech in his usual manner at other times, by addressing to his audience, bespeaking their favour and attention, or letting them gradually into the design of what he was about to say; but as Catiline was present, he immediately falls upon him with vehemence, in the following manner: "How far, Catiline, will you abuse our patience? How long will your fury insult us? What bounds will you set to your unbridled rage? Does neither the night-guard of the palace, nor the city-watch, nor the people's fear, nor the agreement of all good men, nor the meeting of the senate in this fortified place, nor the countenances and looks of this assembly, at all move you? Do not you perceive your designs are discovered, and that all who are present know of your conspiracy? Who of us, do you think, is ignorant of what you did the last night, and the night before, where you was, who was with you, and what you resolved on? O times, O manners! The senate knows this, the consul sees it; and yet this man lives! —lives? nay, comes into the senate, joins in the public counsels, observes and marks out each of us for destruction!" And in the same impetuous strain he proceeds through

through his whole speech, interspersing a great variety of the like strong and moving figures. And the discourse had its desired effect: for when Catiline stood up afterwards to make his defence, the whole senate was so inflamed, and their resentments against him rose so high, from what Cicero had said, that they had not patience to hear him speak; upon which he left both them and the city. Had Cicero, instead of venting his just indignation against the author of so barbarous and inhuman a design, in the manner he did, by figures suited to strike the passions of his hearers; had he, instead of this, attempted to reason with him, and told the story in a cold and lifeless manner, he would have exposed himself to the contempt of Catiline; and by leaving the senate little or nothing moved at what he said, prevented perhaps their coming to those speedy and vigorous resolutions which were necessary at so critical a juncture. Let us suppose him to have expostulated with Catiline in much the same words as before, but thrown into a different form, and divested of those pathetic figures. As thus: "Catiline, you have really abused our patience to a great degree. You have insulted us with your furious proceedings a long while. You seem to have fixed no bounds to your unbridled rage. Neither the night-guard of the palace, nor the city-watch, nor the people's fear, nor the agreement among good men, nor the calling together of the senate in this fortified place, nor the countenances and looks of this assembly, appear to move you in the least. I assure you we are all of us apprised of what you did the last night, and the night before, where you was, and who were with you, and what resolutions you came to. These are sad times, the age is very degenerate; that the senate should know all this, the consul see it; and yet that this man should live, come into the senate, hear all our debates, and mark us out to destroy us." You see the sense is entirely the same, and the words too in a great measure; so that there is little more than an alteration in the form of them. And yet who does not perceive how flat and languid such a way of talking must have appeared at that time? and how much it loses of that spirit and energy, which shows itself in Cicero's manner of expression? Had he delivered himself thus, it might indeed have made the senate look upon Catiline as an abandoned wretch, lost to all virtue and goodness, and perhaps have moved some to pity him on that account; as we are easily induced to compassionate persons in such circumstances, especially when descended from noble and virtuous ancestors, which was his case. But sure it would have been ill suited to fire their minds with that generous regard for their country, and the necessary precautions for its security, which the circumstances of the state then required. Nor would Catiline have been at all deterred by it, but rather encouraged in the prosecution of his designs, from the little effect a speech so managed must probably have had upon the minds of the senators. But Cicero knew very well that the passions of mankind are the springs of action: that it is many times not sufficient for an orator to convince their minds, by setting the truth in a clear light; but he must also raise their hopes, alarm their fears, inflame their anger, or excite some other suitable passion, before they will be brought to act with that zeal and fervour which the case may require. And as he was admirably well skilled in this art of touching the passions, he seldom fails to fix upon the proper methods of doing it, and makes choice of such figures and modes of speaking as in the strongest manner represent the emotions of his own mind. For every passion is not to be expressed by the same figures, any more than it is drawn by the same lines, or painted with the same colours. When Dido finds that Æneas is about to leave her, she uses all her arts to detain him. And as persons in great distress are seldom at a loss to express their condition in the most affecting way; she discovers her fear, anger, revenge, with the whole crowd of disorders which then possessed her mind, in a variety of moving figures, suited to raise the counter passions in his breast, as is finely represented by Virgil in that artful speech he has made for her, which we forbear to recite for no other reason but the length of it. But what particular figures are most accommodated to answer the several ends proposed by them, will best appear when we come to treat of them separately.

We shall therefore now proceed to lay down a few directions for the proper use of figures. And first they should always be accommodated to the sentiments, and rise in proportion to the images designed to be conveyed by them. So far as they are founded in reason, they are suited to impress the mind; but where the language outstrips the thought, though it may please the ear, and some weak persons may be carried away with a pomp of words, yet an intelligent hearer will soon see through the thin and airy dress. It is the sense which gives weight to the figure, as that by striking the imagination awakens the mind, and excites it to act in conformity to reason. Again, in the use of pathetic figures, it is generally better to be nervous than copious, that the images, by their closer union, may impress the mind with greater force and energy; though in such figures as are designed for ornament or illustration, a more diffusive way of painting is sometimes agreeable. But farther, the too frequent use of figures ought to be avoided. For what was observed in relation to tropes, is also true with respect to these; that a great number of them is apt to darken and obscure the style. And besides, Cicero's reflection in this case is very just, That "it is hard to say, what should be the reason, that those things, which most affect us with a sensible pleasure, and at first sight soonest move us, do likewise soonest cloy and satiate us." But that it is so, we find by common experience. Lastly, figures should be so interwoven in a discourse, as not to render the style rough and uneven, sometimes high and at other times low; now dry and jejune, then pompous and florid. In a word, they should rather seem to arise from nature than art; to offer themselves, than to be the effect of study; and to appear not like patches upon a face, but the agreeable beauty of a sound and healthful complexion. But of this we shall have occasion to speak more at large hereafter, in treating upon the different kinds or characters of style.

As to the division of figures, which is what remains to be considered, they are usually divided into two sorts, figures of words, and figures of sentences. The difference between them consists in this; that in the former, if you alter the words, or sometimes only the situation of them, you destroy the figure; but in the latter the figure remains, whatever words are made use of,

Elocution.

of, or in what manner soever the order of them is changed. Thus when the name of a person or thing is repeated, to intimate some known property or quality belonging thereto, it is a verbal figure called *place*. Cicero was a true patriot and hearty lover of his country. And therefore we shall use this figure in saying, that *at the time of Catiline's conspiracy Cicero appeared like Cicero*. The sense would remain the same, but the figure would be lost, if we should alter the words, and say, *at that time Cicero appeared like himself*. So when two or more sentences, or members of a sentence, end with the same word, it is called *epistrophe*; as when we say, *To lose all relish of life, is in effect to lose life*. But if only the order of the words be changed in the latter clause thus, *To lose all relish of life, is to lose life in effect*; the figure vanishes. And this is the nature of the verbal figures. But it is not so in figures of sentences: they continue the same, whatever alterations are made in the words. An orator sometimes thinks it proper to change the form of his discourse, and address himself to his audience, or an absent person, or else perhaps to introduce some other person as speaking to them whose words may be supposed to carry greater weight and authority with them than his own. The former of these is called *apostrophe*, and the latter *prosopœia* or *imagery*; which require no certain words or order of expression.

Art. I. Verbal Figures.

[67] Verbal figures distinguished into three sorts; with their various subdivisions.

These may be distinguished into three sorts, as they consist in a *deficiency* of words, a *redundancy*, or a *repetition*.

I. Of the first sort are *ellipsis* and *asyndeton*.

Ellipsis, is when one or more words are wanting in a sentence to complete the construction, and fully express the sense. This figure is often used in proverbial speeches: as when we say, *Many men, many minds*; that is, *have many minds*; and, *The more danger, the more honour*; that is, *gains more honour*. But where more is intended by such expressions than mere brevity, and especially when they are the effect of some passion, the figure receives another name, and is called *aposiopesis*, which is placed among the figures of sentences, where we shall consider it.

Asyndeton, is when the particles that connect the members of a sentence one with another are left out, to represent either the celerity of an action, or the haste and eagerness of the speaker. Thus Cæsar expresses his speedy conquest of Pharnaces: *I came, I saw, I conquered*. If he had inserted the copulatives, and said, *I came, and I saw, and I conquered*, it would have retarded the expression, and not given so full and just an idea of the swiftness of the action. In the last article we took notice of the vehement and impetuous manner in which Cicero attacked Catiline in his first oration, where his design was to fire the minds of the senate against him, and oblige him to leave the city, both which points he gained by that speech. The next day, therefore, when Catiline was gone, he calls together the body of the citizens, and, makes a speech to them, which in a sort of rapture or transport of mind he thus begins, by acquainting them with the departure of Catiline, *He is gone, departed, escaped, broke out*; intimating at the same time both the excessive rage in which Catiline left Rome, and the great pleasure with which he was himself affected on that account. This concise way of speaking adds likewise a considerable emphasis to an expression, and by bringing the several parts of a thing nearer together affects the mind with a greater force. Thus Cicero sets Cato's character in a very strong and beautiful light by the use of this figure. "Nature itself (says he) has made you a great and excellent man for integrity, gravity, temperance, magnanimity, justice, in a word, for all virtues."

II. The second sort of verbal figures is contrary to these, and consists in a redundancy or multiplicity of words; which are likewise two, *pleonasmus* and *polysyndeton*.

When we use more words than are necessary to express a thing, it is called *pleonasmus*. This is done sometimes for greater emphasis, as when we say, *Where in the world is he?* At other times it is designed to ascertain the truth of what is said: So the servant in Terence, when the truth of what he had related was called in question, replies, *It is certainly so; I saw it with these very eyes*.

When the several parts of a sentence are united by proper particles, it is called *polysyndeton*. This adds a weight and gravity to an expression, and makes what is said to appear with an air of solemnity; and by retarding the course of the sentence, gives the mind an opportunity to consider and reflect upon every part distinctly. We often meet with this figure in Demosthenes, which very well suits with the gravity of his style. So he encourages the Athenians to prosecute the war against King Philip of Macedon, from this consideration, that now "they had ships and men, and money, and stores, and all other things which might contribute to the strength of the city, in greater number and plenty than in former times." Every article here has its weight, and carries in it a proper motive to animate them to the war. But if you remove the copulatives, the sentence will lose much of its force.

III. The third kind of verbal figures consists in a *repetition*. And either the same word in sound or sense, is repeated; or one of a like sound, or signification, or both.

Of the former sort there are ten, called *antanaclasis*, *ploce*, *epizeuxis*, *climax*, *anaphora*, *epistrophe*, *symploce*, *epanalepsis*, *anadiplosis*, and *epanodos*. The two first of these agree in sound, but differ in sense; the eight following agree in both.

When the same word in sound but not in sense is repeated, it is called *antanaclasis*. This figure sometimes carries a poignancy in it; and when it appears natural and easy, discovers a ready turn of thought. As when a son, to clear himself of suspicion, assured his father *he did not wait for his death*; his father replied, *But I desire you would wait for it*. Here the word *wait* is taken in two different senses. It is likewise used on serious occasions, as in grave and moral precepts, which are apt to affect the mind with greater pleasure when delivered in an agreeable dress. As this: *Care for those things in your youth, which in old age may free you from care*: Where the word *care* in the former place signifies to *provide*, and in the latter *anxiety of mind*. And even our Saviour himself once uses this figure, when he says to one of his disciples, who

who desired to be dismissed from attending him, that he might go and bury his father; *Follow me, and let the dead bury their dead:* Where *dead* in one place denotes a *natural death*, and in other a *moral* or *spiritual death*.

Sometimes the name of some person or thing is repeated again, to denote some particular character or property designed to be expressed by it; and then it is called *ploce*. Thus Cicero says, *Young Cato wants experience, but yet he is Cato;* meaning he had the steady temper of the family. And so in the proverbial expression, *An ape is an ape, dress him ever so fine.*

68 When a word is repeated again with vehemence in the same sense, it is called *epizeuxis*. This figure shows the earnestness of the speaker, and his great concern of mind about what he says; and therefore has a natural tendency to excite the attention of the audience. It is suited to express anger, surprise, sorrow, and several other passions. As when Cicero would express his indignation against Antony for having been the chief instrument in bringing on the civil war, he says to him: *You, you, Antony pushed Cæsar upon the civil war.* And thus he tells Catiline in his first invective against him: *You live; and live, not to lay aside, but to pursue, your wicked design.* And when our Saviour would express his great concern and sorrow for the wickedness of the Jews, he does it in this pathetic manner: *O Jerusalem, Jerusalem, who killest the prophets.*

69 *Climax* is a beautiful kind of repetition, when the word, which ends the first member of a period, begins the second, and so through each member, till the whole is finished. There is a great deal of strength as well as beauty in this figure, where the several steps rise naturally, and are closely connected with each other. As in this example: *There is no enjoyment of property without government, no government without a magistrate, no magistrate without obedience, and no obedience where every one acts as he pleases.* But as Quintilian observes, this figure lies so open, that it is apt to look too much like art; for which reason he advises not to use it often. To prevent this, therefore, orators sometimes disguise it, by not repeating the same word which stood in the former member, but some other equivalent to it. As in the following instance of Cicero for Milo: "Nor did he commit himself only to the people, but also to the senate; nor to the senate only, but likewise to the public forces; nor to these only, but also to his power with whom the senate had entrusted the whole commonwealth.

70 When several sentences, or members of a sentence, begin with the same word, it is called *anaphora*. This is a lively and elegant figure, and serves very much to engage the attention. For by the frequent return of the same word the mind of the hearer is held in an agreeable suspense, till the whole is finished. "You do nothing (says Cicero to Catiline), you attempt nothing, you think nothing, but what I not only hear, but also see, and plainly perceive." It is frequently used by way of question; which renders it not only beautiful, but likewise strong and nervous. As at the beginning of the same speech: "Does neither the night-guard of the palace, nor the city-watch, nor the people's fear, nor the agreement of all good men, nor the meeting of the senate in this fortified place, nor the countenances and looks of this assembly, at all move you?" And in another of his orations: "What is so popular as peace, which seems to afford a pleasure, not only to beings endowed with sense, but even to inanimate nature? What is so popular as liberty, which even beasts as well as men seem to covet and prefer above all things? What is so popular as ease and leisure, for the enjoyment of which you and your ancestors have undergone the greatest labours?

Epistrophe is contrary to the former, and makes the repetition at the end of each member or sentence. As thus; "*Since concord was lost; friendship was lost, fidelity was lost, liberty was lost; all was lost.*" And Cicero, in the charge which he brings against Mark Antony before the senate, makes use of this figure, when he says, "Do you lament the destruction of three Roman armies? the author of that destruction was Antony. Do you bewail the loss of most eminent citizens? They have been taken from you by Antony. Is the authority of this order weakened? It is weakened by Antony." 71

Symploce takes in both these last figures. As in that of Cicero: "You would pardon and acquit him, whom the senate hath condemned, whom the people of Rome have condemned, whom all mankind have condemned." Here the several members both begin and end with the same word. We have a beautiful instance of it in St Paul, when he says, "Are they Hebrews? so am I. Are they Israelites? so am I. Are they the seed of Abraham? so am I." 72

When a sentence concludes with the word with which it began, it is called *epanalepsis*. As in that expression of Plautus, "Virtue contains all things; he wants no good thing who has virtue." The figure is the same, but the principle not so honest, in the advice which we find given by the miser in Horace, when he says, "Get money, if you can, honestly; but however, get money." This figure adds a force to an expression, when the principal thing designed to be conveyed is thus repeated, by leaving it last upon the mind. And it heightens the beauty of it, when the sentence has an agreeable turn arising from two opposite parts. As in Cicero's compliment to Cæsar: "We have seen your victory terminated by the war; your drawn sword in the city we have not seen." Hermogenes calls this a *circle*, because the sentence returns again to the same word, as that geometrical figure is formed by the orbicular motion of a line to the same point. 73

When the following sentence begins with the same word with which the former concluded, it is termed *anadiplosis* As in the following instance: *Let us think no price too great for truth; truth cannot be bought too dear.* So in that passage of St John: *He came to his own, and his own received him not.* This figure generally suits best with grave and solemn discourses. 74

Epanodos is the inversion of a sentence, or repeating it backwards, so that it takes in the two last figures; for it both begins and ends with the same word, and the same word is likewise repeated in the middle. This turn of expression has a beauty in it, and shows a readiness of thought. We have the following example of 75

Elocution. of it in Minutius Felix, where he is exposing the folly of the Egyptian superstition. "Isis (says he), with Cynocephalus and her priests, laments, bemoans, and seeks her lost son; her attendants beat their breasts, and imitate the grief of the unhappy mother; in a little time the son is found, upon which they all rejoice. Nor do they cease every year to lose what they find, or to find what they lose. And is it not ridiculous to lament what you worship, or to worship what you lament?" It serves likewise to illustrate and enforce the sense, by setting it in two opposite views. As in that expression of the prophet: "Wo unto them who call good evil, and evil good; who put darkness for light, and light for darkness!"

These figures which consist in a repetition of words of a like sound or signification, or both, are four; *paronomasia*, *homoioptoton*, *synonymia*, and *derivatio*; the two first of which respect words that are similar in sound only, the third in sense, and the last in both.

76 When two words very near in sound, but different in sense, respect each other in the same sentence, it is called *paranomasia*. As when we say, *After a feast comes a fast*; and, *A friend in need is a friend indeed.* We usually call it a *pun*, which when new, and appositely used, passes for wit, and serves to enliven conversation. Nor is it wholly to be excluded from grave and serious discourses: for a witty jest has many times had a better effect than a solid argument, and prevailed with those who could not be moved by close reasoning. And therefore Cicero and the best speakers have sometimes recourse to it upon weighty and solemn occasions, as will be shown hereafter in its proper place.

77 When the several parts of a sentence end with the same case, or tense of a like sound, this also is considered as a figure, and named *homoioptoton*. As thus: *No marvel though wisdom complain that she is either wilfully despised, or carelessly neglected: either openly scorned, or secretly abhorred.* This figure is esteemed most beautiful when the parts are all of the same length, or pretty near it; as it adds to the harmony of the period, and renders the cadency of the several members more musical from the just proportion between them. The Greek rhetoricians were much addicted to this figure, and Isocrates is particularly celebrated for it. But some of the best orators seem to have industriously avoided it, as carrying in it too much the appearance of art. And it is remarkable, that this figure appears nowhere so much in all the works of Demosthenes, as in an oration which he did not speak himself, but wrote for his friend Diodorus, a man of that taste, who was to pronounce it as his own.

78 The next figure above mentioned is *synonymia*. Now strictly speaking, synonymous words are those which have exactly the same sense. But there being few such, the use of the term is so far extended as to comprehend words of a near affinity in their signification, which in discourse are frequently put for one another. So, *to desire*, and *intreat*, are sometimes used as equivalent terms; whereas *to desire* is no more than to wish for a thing, and *to intreat* is to express that inclination in words. In like manner, *esteem* and *honour* are often taken for synonymous words, though they have not precisely the same sense, but one is the usual consequence of the other; for esteem is the good opinion we entertain of a person in our mind, and honour the outward expression of that opinion. When two or more such words come together, they constitute this figure. As when Cicero, speaking of Piso, says, "His whole countenance, which is the tacit language of the mind, has drawn men into a mistake, and deceived, cheated, imposed on those who did not know him." This figure sometimes adds force to an expression, by enlivening the idea; and it often promotes the harmony and just cadency of a sentence, which otherwise would drop too soon, and disappoint the ear.

When such words as spring from the same root, as *justice*, *just*, *injustice*, *unjust*, and the like, come together in the same sentence, they make the figure called *derivatio*. Cicero, observing the vanity of the philosophers who affected praise at the same time that they decried it, used this figure, when he says of them, "The philosophers set their names to those very books which they write for the contempt of glory; and are desirous to be honoured and applauded, even for what they say in contempt of honour and applause." This figure receives an additional beauty when repeated, especially in two opposite members; as, *He wished rather to die a present death, than to live a miserable life.* 79

Art. II. Figures *of* Sentences.

Of these, some are principally adapted for reasoning, and others to move the passions. 80

I. *Those suited for proof*, Which are six: *Prolepsis*, *hypobole*, *anacoinosis*, *epitrope*, *parabole*, and *antithesis*. Of figures of sentences; some are for reasoning and some for moving the passions.

Prolepsis or *anticipation*, is so called, when the orator first starts an objection, which he foresees may be made either against his conduct or cause, and then answers it. Its use is to forestal an adversary, and prevent his exceptions, which cannot afterwards be introduced with so good a grace. Though it has likewise a farther advantage, as it serves to conciliate the audience, while the speaker appears desirous to represent matters fairly, and not to conceal any objection which may be made against him. The occasions of this figure are various; and the manner of introducing it very different. Sometimes the orator thinks it necessary to begin with it, in order to justify his conduct, and remove any exceptions which may be made against his design. Cicero, for several years together, after he first began to plead, had always been for the defendant in criminal cases. And therefore, when he was prevailed with to undertake the accusation of Verres, he begins his oration with this apology for himself: "If any one present should wonder, that when for several years past I have so conducted myself as to defend many and accuse none, I now on a sudden alter my custom, and undertake an accusation: when he shall have heard the occasion and reason of my design, he will both approve of it, and think no person so proper to manage this affair as myself." And then he proceeds to give an account of the reasons which moved him to engage in it. At other times the objection is admitted as an exception to what has been said, but not so as to affect it in general. Thus, when Cicero has represented the advantages of literature and the polite arts, he starts this objection to what himself had said. "But some one will ask, whether those great men, the memory of whose glorious actions is delivered down to posterity, were acquainted with that sort of learning

Elocution. I so applaud?" To which he replies, "Indeed this can scarce be said of them all. However, the answer is easy. I have known several persons of excellent abilities, who, without learning, by the force of an extraordinary genius have been men of great virtue and solidity. Nay, I will add, that nature without learning, has oftener produced these qualifications, than learning without a genius. But yet it must still be owned, that where both these meet, they form something very excellent and singular." Again, at other times, the orator artfully represents the objection as something considerable and important, to give the greater weight to his answer when be has confuted it. Cicero, in his celebrated oration for the Manilian law, could not omit to take notice, that Lucullus had already gained several very considerable advantages over Mithridates. And therefore, having before described the war as very great and dangerous, apprehending these two accounts might appear somewhat inconsistent, and be liable to an objection, he puts it thus artfully himself: "But now, after what I have said of Lucullus, it may probably be asked, How then can the war be so great? be pleased to hear, for there seems to be very just reason for this question." And then he proceeds to show, from the power of King Mithridates at that time, his great abilities, long experience in military affairs, and fresh alliances, that the war was yet very great and dangerous. But sometimes, when the orator is sensible that what he has advanced lies open to an objection, he omits to make it in express terms; and yet proceeds to vindicate what he had said, as if it had been made. Thus, when Cicero had charged Verres with having plundered the inhabitants of Sicily of all their plate, jewels, and other valuable moveables, which he thought worth while to carry away; as the audience might imagine this to be scarce credible, he takes it for granted they thought so, and therefore immediately, adds, "As strange as this is, I affirm it positively, without any intention to aggravate the crime." And so he goes on to the proof of his assertion. But this figure is likewise made use of to guard against some objection, which the speaker apprehends may be made against what he designs to say. And thus Cicero uses it in his oration for Sextius. "My province (says he), as I speak last, seems to call for affection to my friend, rather than his defence; complaint, rather than eloquence; expressions of grief, rather than art. And therefore, if I shall express myself with more warmth, or greater freedom, than those have who spoke before me, I hope you will grant me all that liberty of speech which you judge reasonable to be allowed to an affectionate sorrow and just resentment." This figure requires great prudence and discretion in the management of it. The speaker must consider well the temper, bias, and other circumstances of his hearers, in order to form a right judgment what parts of his discourse may be most liable to exception. For to object such things, which the hearers would never have thought of themselves, is to give himself a needless trouble; and to start such difficulties, which he cannot afterwards fairly remove, will expose both himself and his cause. But as nothing gives an audience greater pleasure and satisfaction, than to have their scruples fully answered as they rise in their thoughts; so, on the contrary, be a discourse otherwise ever so entertaining and agreeable, if there be any doubt left upon the minds of the hearers, it gives them a pain that continues with them till it be removed. Elocution.

The figure *hypobole* or *subjection*, is not much unlike the former; and is, when several things are mentioned that seem to make for the contrary side, and each of them refuted in order. It consists of three parts, when complete; a proposition, an enumeration of particulars with their answers, and a conclusion.—Thus Cicero, upon his return from banishment, vindicates his conduct in withdrawing so quietly, and not opposing the faction that ejected him. "My departure (says he) is objected to me; which charge I cannot answer without commending myself. For what must I say? That I fled from a consciousness of guilt? But what is charged upon me as a crime, was so far from being a fault, that it is the most glorious action since the memory of man, (he means his punishing the associates of Catiline). That I feared being called to an account by the people? That was never talked of; and if it had been done, I should have come off with double honour. That I wanted the support of good and honest men? That is false. That I was afraid of death? That is a calumny. I must therefore say, what I would not, unless compelled to it, that I withdrew to preserve the city." When the objections are put by way of question, as in the example here given, they add a briskness and poignancy to the figure. All the parts of it are not constantly expressed. For thus Cicero in his defence of Plancius introduces his adversary objecting, and himself answering, "The people judged ill, but they did judge; they should not have done it, but they had a power; I cannot submit to it, but many very great and wise men have."—Both the proposition and conclusion are here omitted. 81

The next figure in order is *anacoinosis*, or *communication*; by which the speaker deliberates either with the judges, the hearers, or the adversary himself. Thus Cicero addresses the judges in his accusation of Verres: "Now I desire your opinion what you think I ought to do. And I know your advice will be, though you do not declare it, what appears to me necessary to be done." In another place we find him reasoning in this manner with the adverse party: "What could you have done in such a case, and at such a time: when to have sat still, or withdrawn, would have been cowardice? When the wickedness and fury of Saturnius the tribune had called you into the capitol; and the consuls, to defend the safety and liberty of your country; whose authority, whose voice, which party would you have followed, and whose command would you have chosen to obey?" This figure carries in it an air of modesty and condescension, when the speaker seems unwilling to determine in his own cause, but refers it to the opinion of others. It likewise shows a persuasion of the equity of his cause, that he can leave it to their arbitration; and serves very much to conciliate their minds, while he joins them, as it were with himself, and makes them of his party. And when the appeal is made to the adverse party, it is of considerable advantage, either to extort a confession, or at least to silence him. And therefore the sacred writers sometimes very beautifully introduce God himself thus expostulating with mankind; as the prophet Malachi, 82

Malachi, *A son honoureth his father, and a servant his master. If then I be a father, where is mine honour? and if I be a master, where is my fear?*

83 Another figure that comes under this head, is *epitrope* or *concession;* which grants one thing, to obtain another more advantageous. It is either real or feigned; and either the whole of a thing, or a part only, is granted. We shall consider each of these separately, and illustrate them with proper examples. Nothing more confounds an adversary, than to grant him his whole argument; and at the same time either to show that it is nothing to the purpose, or to offer something else which may invalidate it. *I allow*, says the claimant by will against the heir at law, *that no body was more nearly related to the deceased than you; that he was under some obligations to you; that you were in the army together: but what is all this to the will?* And thus Cicero in his defence of Ligarius, who was accused by Tubero for having joined with Pompey in the civil war between him and Cæsar: "You have, Tubero, what an accuser would most desire, the accused person confessing the charge; but so as to affirm, that he was of the same party with you and your excellent father. Therefore own first that it was a crime in yourself, before you charge it as such upon Ligarius." Sometimes the orator gives up some particular point that would well admit of a dispute, to gain something more considerable, which he thinks cannot fairly be denied him. In the affair of Roscius, where the proof depended upon circumstances, Cicero, who defended him, inquires what reason could be alleged for his committing so black a crime, as to kill his father. And after he has shown there was no probable reason to be assigned for it, he adds, "Well, since you can offer no reason, although this might be sufficient for me, yet I will recede from my right; and upon the assurance I have of his innocence, I will grant you in this cause what I would not in another. I do not therefore insist upon your telling me why he killed his father, but ask how he did it?" This appearance of candour and ingenuity in such concessions removes the suspicion of art, and gives greater credit to what is denied. We have an example of a feigned or ironical concession in Cicero's defence of Flaccus: where, interceding for him on the account of his former good services in the time of Catiline's conspiracy, he says in a way of irony, If such things are to be overlooked, "let us appease the ghosts of Lentulus and Cethegus; let us recal those who are in exile; and let us be punished for our too great affection and love for our country." By this artful insinuation, the orator, after he has used all his arguments to persuade his hearers, does as it were set them at liberty, and leave them to their own election; it being the nature of man to adhere more steadfastly to what is not violently imposed, but referred to his own free and deliberative choice. And to these feigned concessions may be referred such ways of reasoning, by which the orator both justifies a charge brought against him upon the supposition of its being true, and also proves that the charge itself is false. Thus Cicero, in his defence of Milo, represents the taking of Clodius, with which Milo was accused, as a glorious action; after he has shown that Milo's servants did it without the knowledge of their master.

84 *Parabole* or *similitude*, illustrates a thing by comparing it with some other, to which it bears a resemblance. Similitudes are indeed generally but weak arguments, though often beautiful and fine ornaments. And where the design of them is not so much to prove what is doubtful, as to set things in a clear and agreeable light, they come properly under the notion of figures. They are of two sorts; simple and compound. Those are called *simple*, in which one thing only is likened or compared to another, in this manner: *As swallows appear in summer, but in winter retreat; so false friends show themselves in prosperity, but all fly away when adversity approaches.* Compound similitudes are such, wherein one thing is likened or compared to several others; as thus: *What light is to the world, physic to the sick, water to the thirsty, and rest to the weary; that is knowledge to the mind.* The more exact the agreement is between the things thus compared, they give the greater beauty and grace to the figure.

Antithesis, or *opposition*, by which things contrary or different are compared, to render them more evident. 85 Thus Cicero says, "The Roman people hate private luxury, but love public grandeur." This is a very florid figure; and suited no less for amplification than proof. As in the following instance of Cicero, where, speaking of Pompey, he says, "He waged more wars than others had read; conquered more provinces than others had governed; and had been trained up from his youth to the art of war, not by the precepts of others, but by his own commands; not by miscarriages in the field, but by victories; not by campaigns, but triumphs." It is esteemed a beauty in this figure when any of the members are inverted, which some call *antimetathesis*. As where Cicero, opposing the conduct of Verres when governor of Sicily, to that of Marcellus who took Syracuse the capital city of that island, says, "Compare this peace with that war, the arrival of this governor with the victory of that general, his profligate troops with the invincible army of the other, the luxury of the former with the temperance of the latter; you will say, that Syracuse was founded by him who took it, and taken by him who held it when founded." To this figure may also be referred *oxymoron*, or *seeming contradiction:* that is, when the parts of a sentence disagree in sound, but are consistent in sense. As when Ovid says of Althea, that *she was impiously pious*. And so Cato used to say of Scipio Africanus, that "he was never less at leisure, than when he was at leisure; nor less alone, than when alone." By which he meant, as Cicero tells us, that "Scipio was wont to think of business in his retirement, and in his solitude to converse with himself." This is a strong and bold figure, which awakens the mind, and affords it an agreeable pleasure to find upon reflection, that what at first seemed contradictory, is not only consistent with good sense, but very beautiful.—The celebrated Dr Blair, whom we have more than once quoted in this article, has these observations on antithesis, or the contrast of two objects. "Contrast has always this effect, to make each of the contrasted objects appear in the strongest light. White, for instance, never appears so bright as when it is opposed to black, and when both are viewed together. Antithesis, therefore, may, on many occasions be employed to advantage, in order to strengthen the impression which we intend that any object should make. In order to render an antithesis more complete, it is always

Elocution. always of advantage that the words and members of the sentence, expressing the contrasted objects, be similarly constructed, and made to correspond to each other. This leads us to remark the contrast more, by setting the things which we oppose more clearly over against each other: in the same manner as when we contrast a black and a white object, in order to perceive the full difference of their colour, we would choose to have both objects of the same bulk, and placed in the same light. Their resemblance to each other, in certain circumstances, makes their disagreement in others more palpable. At the same time I must observe, that the frequent use of antithesis, especially where the opposition in the words is nice and quaint, is apt to render the style disagreeable. A maxim, or moral saying, properly enough receives this form; both because it is supposed to be the fruit of meditation, and because it is designed to be engraved on the memory, which recals it more easily by the help of such contrasted expressions. But where a string of such sentences succeed each other, where this becomes an author's favourite and prevailing manner of expressing himself, his style is faulty; and it is upon this account Seneca has been often and justly censured. Such a style appears too studied and laboured; it gives us the impression of an author attending more to his manner of saying things, than to the things themselves which he says." There is still another kind of antithesis, which consists in surprising us by the unexpected contrasts of things which it brings together; but it is such as is wholly beneath the dignity of an orator, or of grave compositions of any sort, and is fit only for pieces of professed wit and humour, calculated only to excite laughter or create ridicule.

86 The second kind of figures of sentences.

II. *Those suited to move the passions.* Which are 13; namely, *epanorthosis*, *paralepsis*, *parrhesia*, *aparithmesis*, *exergasia*, *hypotyposis*, *aporia*, *posiopesis*, *erotesis*, *ecphonesis*, *epiphonema*, *apostrophe*, and *prosopopeia*.

Epanorthosis, or *correction*, is a figure, by which the speaker either recals or amends what he had last said. It is used different ways. For sometimes one or more words are recalled by him, and others subjoined in their room; at other times, without recalling what has been said, somethingelse is substituted as more suitable. This is a very extensive figure, and made use of in addressing different passions. We have an instance of it in Terence's *Self-tormentor*, where the old man, whose extraordinary concern for the absence of his son gave occasion to the name of the play, thus bewails his condition to his neighbour. "I have an only son, Chremes. Alas! did I say that I have: I had indeed; but it is now uncertain whether I have or not." Here, to aggravate his misfortune, he recals a pleasing word, and substitutes another more affecting in its place. And Cicero, in his defence of Milo, speaking to the judges concerning Clodius, says, "Are you only ignorant what laws, if they may be called laws, and not rather torches and plagues of the state, he was about to impose and force upon us?" Again, in his defence of Plancius, he says, "What greater blow could those judges, if they are to be called judges, and not parricides of their country, have given to the state, than when they banished him, who when prætor freed the republic from a neighbouring war, and when consul from a civil one?" He is speaking there of Opimius. But in commending the moderation of Lucius Mummius, who did not enrich himself, but his country, by demolishing the wealthy city of Corinth, he thus recals his whole expression, and by giving it a new turn, heightens the compliment he designed him: "He chose rather (says he) to adorn Italy than his own house; though by adorning Italy his house seems to have received the greatest ornament." And sometimes the correction is made by substituting something contrary to what has been said before; as in the following passage of Cicero: "Cæsar (meaning Augustus), though but a youth, by an incredible and surprising resolution and courage, when Antony was most enraged, and we dreaded his cruel and pernicious return from Brundusium, at a time when we neither asked, nor expected, nor desired it (because it was thought impossible), raised a very powerful army of invincible veterans; to effect which he threw away his whole estate: Though I have used an improper word; for he did not throw it away, but employed it for the safety of the government." At other times, as has been said, the correction is made by adding a more suitable word, without any repetition of the former. Thus Cicero, after he has inveighed against the crimes of Verres, breaks out into this pathetic exclamation: *O the clemency, or rather wonderful and singular patience, of the Roman people!* He did not think the word *clemency* strong enough, and therefore adds *patience*, as better answering his design. The sudden and unexpected turn of this figure gives a surprise to the mind, and by that means renders it the more pathetic.

Paralepsis, or *omission*, is another of these figures, 87
when the speaker pretends to omit, or pass by, what at the same time he declares. It is used either in praise or dispraise. Thus Cicero, in his defence of Sextius, introduces his character in this manner, with a design to recommend him to the favour of the court: "I might say many things of his liberality, kindness to his domestics, his command in the army, and moderation during his office in the province: but the honour of the state presents itself to my view; and calling me to it, advises me to omit these lesser matters." But in his oration to the senate against Rullus the tribune, who had proposed a law to sell the public lands, he makes use of this figure to represent the pernicious effects of such a law, particularly with respect to the lands in Italy. "I do not complain (says he) of the diminution of our revenues, and the woeful effects of this loss and damage. I omit what may give every one occasion for a very grievous and just complaint, that we could not preserve the principal estate of the public, the finest possession of the Roman people, the fund of our provisions, the granary of our wants, a revenue entrusted with the state; but that we must give up those lands to Rullus, which, after the power of Sylla, and the largesses of the Gracchi, are yet left us. I do not say, this is now the only revenue of the state, which continues when others cease, is an ornament in peace, fails us not in war, supports the army, and does not fear an enemy. I pass over all these things, and reserve them for my discourse to the people, and only speak at present of the danger of our peace and liberties." His view here was to raise the indignation of the senate against Rullus, and excite them to oppose the law. There is a beautiful instance of this figure in St Paul's epistle to Philemon, where, after he has earnestly intreated him to receive again Onesimus his servant, who had run from him, and promised that if he

he had wronged him, or owed him any thing, he would repay it, he adds, *That I may not say, you owe even yourself to me.* Nothing could be a stronger motive to soften his displeasure against his servant, from a sense of gratitude to the apostle. Hermogenes has observed, that the design of this figure is to possess the minds of the audience with more than the words express, and that it is principally made use of on three occasions: either when things are small, but yet necessary to be mentioned; or well known, and need not to be enlarged on; or ungrateful, and therefore should be introduced with caution, and not set in too strong a light.

88 The next figure above-mentioned was *Parrhesia*, or *reprehension:* Not that whenever a person admonishes or reproves another it is to be esteemed a figure; but when it is done with art and address, and in such circumstances as render it difficult not to displease.—The orator therefore sometimes prepares his hearers for this by commending them first, urging the necessity of it, representing his great concern for them as his motive, or joining himself with them. Thus Cicero charges the senate with the death of Servius Sulpicius, for sending him to Mark Antony, under a very ill state of health. And his design in it was to bring them more readily into a motion he was about to make, that both a statue and a sepulchral monument might be erected to his memory at the public expence. "You (says he), it is a very severe expression, but I cannot help saying it; you, I say, have deprived Servius Sulpicius of his life. It was not from cruelty indeed (for what is there with which this assembly is less chargeable?), but when his distemper pleaded his excuse more than his words, from the hopes you conceived that there was nothing which his authority and wisdom might not be able to effect, you vehemently opposed his excuse, and obliged him, who always had the greatest regard for your commands, to recede from his resolution." Sometimes, indeed, the orator assumes an air of reproof, with a view only to pass a compliment with a better grace. As Cicero in his address to Cæsar, when he says, "I hear that excellent and wise saying from you with concern, That you have lived long enough, either for the purposes of nature, or glory: for nature, perhaps, if you think so: and, if you please, for glory: but, what is principally to be regarded, not for your country." It adds both a beauty and force to this figure, when it is expressed in a way of comparison. As in the following instance of Cicero: "But since my discourse leads me to this, consider how you ought to be affected for the dignity and glory of your empire. Your ancestors often engaged in war to redress the injuries of their merchants or sailors: how ought you then to resent it, that so many thousand Roman citizens were murdered by one message, and at one time? Your forefathers destroyed Corinth, the principal city in Greece, for the haughty treatment of their ambassadors; and will you suffer that king to go unpunished, who has put to death a Roman legate, of consular dignity, in the most ignominious as well as most cruel manner? See, lest, as it was their honour to leave you the glory of so great an empire, it should prove your disgrace not to be able to maintain and defend what you have received from them." By this figure an address is made to the more tender passions, modesty, shame, and emulation, the attendants of an ingenuous temper, which is soonest touched, and most affected, by a just reproof.

Another of these pathetic figures is *Aparithmesis*, or *enumeration*, when that, which might be expressed in general by a few words, is branched out into several 89
particulars, to enlarge the idea, and render it the more affecting. Cicero, in pleading for the Manilian law, where his design is to conciliate the love and esteem of the people to Pompey, thus enlarges upon his character: "Now, what language can equal the virtue of Cneius Pompey? What can be said either worthy of him, or new to you, or which every one has not heard? For those are not the only virtues of a general which are commonly thought so; labour in affairs, courage in dangers, industry in acting, despatch in performing, design in contriving; which are greater in him than in all other generals we have ever seen or heard of." And so likewise, when he endeavours to dispossess Pompey of the apprehension that Milo designed to assassinate him: "If (says he) you fear Milo; if you imagine that either formerly, or at present, any ill design has been formed by him against your life; if the soldiers raised through Italy (as some of your officers give out), if these arms, if these cohorts in the Capitol, if the centries, if the watch, if the guards which defend your person and house, are armed to prevent any attempt of Milo, and all of them appointed, prepared, and stationed on his account; he must be thought a person of great power, and incredible resolution, above the reach and capacity of a single man, that the most consummate general, and the whole republic, are in arms against him only. But who does not perceive, that all the disordered and sinking parts of the state are committed to you, to rectify and support them by these forces?" This might have been said in a few words, that such vast preparations could never be intended for so low a purpose. But the orator's view was to expose that groundless report, and shame it out of countenance. And soon after he endeavours to raise compassion for Milo under those prejudices by the same figure: "See how various and changeable is the state of human life, how unsteady and voluble is fortune, what infidelity in friends, what disguises suited to the times, what flights, what fears, even of the nearest acquaintance, at the approach of dangers." Had no address to the passions been designed here, fewer of these reflections might have been sufficient. The use of this figure in amplification is very evident from the nature of it, which consists in unfolding of things, and by that means enlarging the conception of them.

Exergasia, or *exposition*, has an affinity with the former figure: but it differs from it in this, that it consists 90
of several equivalent expressions or nearly such, in order to represent the same thing in a stronger manner; whereas the other enlarges the idea by an enumeration of different particulars. So that this figure has a near relation to synonymia, of which we have treated before under *Verbal Figures.* We have an instance of it in Cicero's defence of Sextius, where he says, "Those who at any time have excited the populace to sedition, or blinded the minds of the ignorant by corruption, or traduced brave and excellent men, and such as deserved well of the public, have with us always been esteemed vain, bold, bad, and pernicious citizens. But those who repressed the attempts and endeavours of such, or by their authority, integrity, constancy, resolution, and prudence, withstood their insolence, have been always accounted men of solidity, the chiefs, the leaders, and supporters

supporters of our dignity and government." Nothing more is intended by this passage, but to set the opposite characters of factious persons and true patriots in the strongest light, with a view to recommend the one, and create a just hatred and detestation of the other. So elsewhere he represents the justice of self-defence in no less different terms: "If reason (says he) prescribes this to the learned, and necessity to barbarians, custom to nations, and nature itself to brutes, always to ward off all manner of violence, by all possible ways; from their body, from their head, from their life; you cannot judge this to be a criminal and wicked action, without judging at the same time that all persons who fall among robbers and assassins must either perish by their weapons, or your sentence."—He is addressing here to the judges in favour of Milo. The warmth and vehemence of the speaker often runs him into this figure, when he is affected with his subject, and thinks no words, no expressions, forcible enough to convey his sentiments; and therefore repeats one after another, as his fancy suggests them. This flow of expression, under the conduct of a good judgment, is often attended with advantage; as it warms the hearers, and impresses their minds, excites their passions, and helps them to see things in a stronger light.

91 *Hypotyposis*, or *imagery*, is a description of things painted in such strong and bright colours, as may help the imagination of the hearers to conceive of them rather as present to their view, than described in words. It is peculiarly suited for drawing characters; and often affords the finest ornaments in poetry and history, as well as oratory. Nor is it less moving, but suited to strike different passions, according to the nature of the subject, and artful management of the speaker. Cicero has thus drawn the picture of Catiline, consisting of an unaccountable mixture of contrary qualities. "He had (says he) the appearance of the greatest virtues: he made use of many ill men to carry on his designs, and pretended to be in the interest of the best men; he had a very engaging behaviour, and did not want industry and application; he gave into the greatest looseness, but was a good soldier. Nor do I believe there was ever the like monster in the world, made of such jarring and repugnant qualities and inclinations. Who at one time was more acceptable to the best men, and who more intimate with the worst? Who was once a better patriot, and who a greater enemy to this state? Who more devoted to pleasures, who more patient in labours? Who more rapacious, and yet more profuse? He suited himself to the humours of all he conversed with: was serious with the reserved, and pleasant with the jocose; grave with the aged, and facetious with the young; bold with the daring, and extravagant with the profligate." Such a character of a man, when accompanied with power and interest, must render him no less the object of fear than detestation, which was the design of Cicero in this description. And elsewhere, in order to prevail with the senate to direct the execution of those conspirators with Catiline who were then in prison, he paints the most dismal scene of that horrid design in the strongest colours. "Methinks (says he) I see this city, the light of the world, and citadel of all nations, suddenly falling into one fire; I perceive heaps of miserable citizens buried in their ruined country; the countenance and fury of Cethegus raging in your slaughter, presents itself to my view." This figure is very serviceable to amplification, as we have formerly shewn in treating upon that subject. But no small judgment is required in the management of descriptions. Lesser circumstances should either be wholly omitted, or but slightly touched; and those which are more material drawn in their due proportion. Nature is as much the rule of the orator as of the painter, and what they both propose to imitate. And therefore, let a thought be ever so pleasing and beautiful in itself, it must not be introduced when foreign to the purpose, or out of its place, any more than a painter should attempt to alter nature when he proposes to copy it. This figure requires likewise a vigorous and lively genius. For the images in description can rise no higher than the conception of the speaker, since the idea must first be formed in his own mind before he can convey it to others; and agreeably to the clearness with which he conceives it himself, he will be able to express it in words.

Aporia, or *doubt*, expresses the debate of the mind with itself upon a pressing difficulty. A person in such a state is apt to hesitate, or start several things successively, without coming to any fixed resolution. The uneasiness arising from such a disorder of thought is naturally very moving. Of this kind is that of Cicero for Cluentius, when he says, "I know not which way to turn myself. Shall I deny the scandal thrown upon him of bribing the judges? Can I say the people were not told of it? that it was not talked of in the court, mentioned in the senate? Can I remove an opinion so deeply and long rooted in the minds of men? It is not in my power. You, judges, must support his innocence, and rescue him from this calumny." Orators sometimes choose to begin their discourse with this figure. A diffidence of mind at first is not unbecoming, but graceful. It carries in it an air of modesty, and tends very much to conciliate the affections of the hearers. Livy gives us a very elegant example of this in a speech of Scipio Africanus to his soldiers, when, calling them together after a sedition, he thus bespeaks them: "I never thought I should have been at a loss in what manner to address my army. Not that I have applied myself more to words than things; but because I have been accustomed to the genius of soldiers, having been trained up in the camp almost from my childhood. But I am in doubt what or how to speak to you, not knowing what name to give you. Shall I call you *citizens*, who have revolted from your country? *Soldiers*, who have disowned the authority of your general, and broke your military oath? *Enemies*? I perceive the mien, the aspect, and habit of citizens; but discern the actions, words, designs, and dispositions of enimies." 92

Sometimes a passion has that effect, not so much to render a person doubtful what to say, as to stop him in the midst of a sentence, and prevent his expressing the whole of what he designed; and then it is called *Aposiopesis*, or *concealment*. It denotes different passions; as anger, which, by reason of its heat and vehemence, causes persons to break off abruptly in their discourse. So the old man in Terence, when he was jealous that his servant obstructed his designs, uses this imperfect but threatening expression, *Whom, if I find*. And Neptune, when described by Virgil as very angry that the winds should presume to disturb the sea without his permission, after he has called them to him to know the reason of it, threatens them in this abrupt manner: 93

"Whom I—but first I'll lay the storm."

But Cicero, in writing to Atticus, applies it to express grief, where he says, "I know nothing of Pompey, and believe he must be taken, if he is not got on shipboard. O incredible swiftness! But of our friend—Though I cannot accuse him without grief, for whom I am in so much concern and trouble." And in a letter to Cassius he uses it to express fear, when he says to him, "Brutus could scarce support himself at Mutina; if he is safe, we have carried the day. But if—heaven avert the omen! all must have recourse to you." His meaning is, "If Brutus should be defeated."

94 The next figure is *erotesis* or *interrogation*. But every interrogation or question is not figurative. When we inquire about a thing that is doubtful, in order to be informed, this is no figure, but the natural form of such expressions. As if I ask a person, *Where he is going?* or *what he is doing?* But then it becomes figurative when the same thing may be expressed in a direct manner; but the putting it by way of question gives it a much greater life and spirit. As when Cicero says, "Catiline, how long will you abuse our patience? do not you perceive your designs are discovered!" He might indeed have said, *You abuse our patience a long while. You must be sensible your designs are discovered.* But it is easy to perceive how much this latter way of expression falls short of the force and vehemence of the former. And so when Medea says, *I could save; and do you ask if I can destroy?* Had she said, *I could save, and I can destroy*, the sentence had been flat, and very unfit to express the rage and fury in which the poet there represents her. This figure is suited to express most passions and emotions of the mind, as anger, disdain, fear, desire, and others. It serves also to press and bear down an adversary. Cicero frequently makes this use of it. As in his defence of Plancius: "I will make you this offer (says he), choose any tribe you please, and show, as you ought, by whom it was bribed; and if you cannot, as I believe you will not undertake it, I will prove how he gained it. Is this a fair contest? Will you engage on this foot? I cannot give you fairer play. Why do you dissemble? Why do you hesitate? I insist upon it, urge you to it, press it, require, and even demand it of you." Such a way of pushing an antagonist shows the speaker has great confidence in his cause; otherwise he would never lay himself so open, if he was not assured the other party had nothing to reply. This figure likewise diversifies a discourse, and gives it a beautiful variety, by altering the form of expression, provided it be neither too frequent, nor continued too long at once. And besides, the warmth and eager manner in which it is expressed, enlivens the hearers, and quickens their attention.

95 *Ecphonesis*, or *exclamation*, is a vehement extension of the voice, occasioned by a commotion of mind, naturally venting itself by this figure, which is used by Cicero to express a variety of passions. It often denotes resentment or indignation. Thus, after his return from banishment, reflecting on those who had occasioned it, he breaks out into this moving exclamation: "O mournful day to the senate, and all good men, calamitous to the state, afflictive to me and my family, but glorious in the view of posterity!" His design was to excite an odium against the authors of his exile, when recalled in so honourable a manner. And again, in his defence of Cælius: "O the great force of truth: which easily supports itself against the wit, craft, subtility, and artful designs of men!" He had been just showing the absurdity of the charge against Cælius, and now endeavours to expose his accusers to the indignation of the court. At other times it is used to express disdain or contempt. As when speaking of Pompey's house, which was bought by Mark Antony, he says: "O consummate impudence! dare you go within that house! dare you enter that venerable threshold, and show your audacious countenance to the tutelar deities which reside there!" Nor is it less suited to indicate grief, as when he says of Milo: "O that happy country, which shall receive this man! ungrateful this, if it banish him! miserable if it lose him!" And sometimes it serves to express admiration: as when, in compliment to Cæsar, he says, "O admirable clemency! worthy of the greatest praise, the highest encomiums, and most lasting monuments!" It has its use also in ridicule and irony. As in his oration for Balbus, where he derides his accuser, by saying, "O excellent interpreter of the law! master of antiquity! corrector and amender of our constitution!" The sacred writers sometimes use it by way of intreaty or wish. As the royal psalmist: "O that I had the wings of a dove, that I might fly away, and be at rest!" And at other times in triumph and exultation, as in that of St Paul: "O death, where is thy sting! O grave, where is thy victory!" It is frequently joined with the preceding figure *interrogation*; as appears in some of the instances here brought from Cicero. And it generally follows the representation of the thing which occasions it. Though sometimes it is made use of to introduce it, and then it serves to prepare the mind by exciting its attention. Thus Cicero, in his defence of Cælius, to render the character of Clodia more odious, at whose instigation he was accused, insinuates that she had before poisoned her husband; and to heighten the barbarity of the fact, and make it appear the more shocking, he introduces the account of it with this moving exclamation: "O heavens, why do you sometimes wink at the greatest crimes of mankind, or delay the punishment of them to futurity!"

Epiphonema, or *acclamation*, has a great affinity with 96
the former figure. And it is so called, when the speaker, at the conclusion of his argument, makes some lively and just remark upon what he has been saying, to give it the greater force, and render it the more affecting to his hearers. It is not so vehement and impetuous as exclamation, being usually expressive of the milder and more gentle passions. And the reflection ought not only to contain some plain and obvious truth, but likewise to arise naturally from the discourse which occasioned it, otherwise it loses its end. When Cicero has shown, that recourse is never to be had to force and violence, but in cases of the utmost necessity, he concludes with the following remark: "Thus to think, is prudence; to act, fortitude; both to think and act, perfect and consummate virtue." And elsewhere, after he has described a singular instance of cruelty and breach of friendship: "Hence (says he) we may learn, that no duties are so sacred and solemn which covetousness will not violate." This figure is frequently expressed in a way of admiration. As when Cicero has observed, that all men are desirous to live to an advanced age, but uneasy under it when

when attained, he makes this just reflection upon such a conduct: "So great is their inconstancy, folly, and perverseness!"

97 The next figure in order is *apostrophe*, or *address*, when the speaker breaks off from the series of his discourse, and adresses himself to some particular person present or absent, living or dead; or to inanimate nature, as endowed with sense and reason. By this means he has an opportunity of saying many things with greater freedom than perhaps would be consistent with decency if immediately directed to the persons themselves. He can admonish, chide, or censure, without giving offence. Nor is there any passion, but may be very advantageously expressed by this figure. When an orator has been speaking of any particular person, on a sudden to turn upon him, and apply the discourse to that person himself, is very moving; it is like attacking an adversary by surprise, when he is off his guard, and where he least expects it. Thus Cicero: "I desire, senators, to be merciful, but not to appear negligent in so great dangers of the state; though at present I cannot but condemn myself of remissness. There is a camp formed in Italy, at the entrance of Etruria, against the state; our enemies increase daily; but we see the commander of the camp, and general of the enemies, within our walls, in the very senate, contriving some intestine ruin to the state. If now, Catiline, I should order you to be seized and put to death, I have reason to fear, that all good men would rather think I had deferred it too long, than charge me with cruelty. But I am prevailed with for a certain reason not to do that yet, which ought to have been done long since." This sudden turn of the discourse to Catiline himself, and the address to him in that unexpected manner, must have touched him very sensibly. So, in his defence of Milo, expressing his concern if he should not succeed in it, he says, "And how shall I answer it to you, my brother Quintus, the partner of my misfortunes, who are now absent?" And elsewhere addressing to the soldiers of the Martian legion, who had been killed in an engagement with Mark Antony, he thus bespeaks them: "O happy death, which, due to nature, was paid to your country! I may esteem you truly born for your country, who likewise received your name from Mars; so that the same deity seems to have produced this city for the world, and you for this city." And in his oration for Balbus, he thus calls upon dumb nature to witness to Pompey's virtues: "I invoke you, mute regions; you, most distant countries; you seas, havens, islands, and shores. For what coast, what land, what place is there, in which the marks of his courage, humanity, wisdom, and prudence, are not extant? An appeal to heaven, or any part of inanimate nature, has something very sublime and solemn in it, which we often meet with in sacred writ. So the divine prophet: "Hear, O heavens! and give ear, O earth! for the Lord hath spoken." And in like manner, the prophet Jeremiah: "Be astonished, O ye heavens, at this." See APOSTROPHE.

98 *Prosopopeia*, or *the fiction of a person*: by which either an absent person is introduced speaking; or one who is dead, as if he was alive and present; or speech is attributed to some inanimate being. There is no figure, perhaps, which serves more or better purposes to an orator than this. For by this means he is enabled to call in all nature to his assistance, and can assign to every thing such parts as he thinks convenient. There is scarce any thing fit to be said, but may be introduced this way. When he thinks his own character is not of sufficient weight to affect his audience in the manner he desires, he substitutes a person of greater authority than himself to engage their attention. When he has severe things to say, and which may give offence as coming from himself; he avoids this, by putting them into the mouth of some other person from whom they will be better taken; or makes inanimate nature bring a charge, or express a resentment, to render it the more affecting. And by the same method he sometimes chooses to secure himself from a suspicion of flattery, in carrying a compliment too high. We meet with several very beautiful instances of this figure in Cicero; but an example of each sort may here suffice, beginning with that of an absent person, from his defence of Milo, whom he thus introduces as speaking to the citizens of Rome: "Should he, holding the bloody sword, cry out, Attend, I pray, hearken, O citizens, I have killed Publius Clodius; by this sword, and by this right hand, I have kept off his rage from your necks, which no laws, no courts of judicature, could restrain; it is by my means, that justice, equity, laws, liberty, shame, and modesty, remain in the city. Is it to be feared how the city would bear this action? Is there any one now, who would not approve and commend it?" And in his oration for Balbus, he introduces Marius, who was then dead, to plead in his defence: Can Balbus (says he) be condemned, without condemning Marius for a like fact? Let him be present a little to your thoughts, since he cannot be so in person; that you may view him in your minds, though you cannot with your eyes. Let him tell you, he was not unacquainted with leagues, void of examples, or ignorant of war." And again, in his first invective against Catiline, he presents his country as thus expostulating with himself, and upbraiding him for suffering such a criminal as Catiline to live. "Should my country (says he), which is much dearer to me than my life, should all Italy, all the state, thus address me, Mark Tully what do you do? Do you suffer him, whom you have found to be an enemy, who you see is to be at the head of the war, whom you perceive your enemies wait for in their camp as their general, who has been the contriver of this wickedness, the chief of the conspiracy, the exciter of slaves and profligate citizens, to leave the city, which is rather to bring him in, than let him out? Will not you order him to be imprisoned, condemned, and executed? What prevents you? The custom of our ancestors. But private persons have often punished pernicious citizens in this state. The laws relating to the punishment of Roman citizens? But traitors never had the rights of citizens. Do you fear the censure of posterity? Truly you make a very handsome return to the people of Rome, who have advanced you from an obscure condition so early to the highest dignity; if you neglect their safety to avoid envy, or from the apprehension of any danger. And if you fear censure; which is most to be dreaded, that which may arise from justice and fortitude, or from cowardice and treachery? When Italy shall be wasted by a war, cities plundered, and houses burnt, do you think then to escape the severest censure?" In the management of this figure, care should be

Elocution. be taken that what is said be always consistent with the character introduced, in which both the force and beauty of it consist.

In treating upon figures, we have hitherto considered them separately; but it may not be amiss to observe, that some expressions consist of a complication of them, and may come under the denomination of several figures, as well verbal as those of sentences, differently considered. Thus when Cicero says, "What, Tubero, did your drawn sword do in the Pharsalian battle? At whose side was its point directed? what was the intention of your arms?" As he speaks to Tubero, it is an apostrophe; as the expressions have much the same import, and are designed to heighten and aggravate the fact, it is *exergasia;* and as they are put by question, it is *interrogation.* So likewise, in his second Philippic, where he says, "What can I think? that I am contemned? I see nothing in my life, interest, actions, or abilities, as moderate as they are, which Antony can despise. Did he think he could easily lessen me in the senate? But they, who have commended many famous citizens for their good government of the state, never thanked any but me for preserving it. Would he contend with me for eloquence? This would be a favour indeed. For what could be a larger and more copious subject, than for me to speak for myself against Antony? His design was really this: he thought he could not convince his associates, that he was truly an enemy to his country, unless he was so first to me." There are three figures in this passage; *doubt*, *interrogation*, and *subjection.* And again, when he introduces Sicily thus addressing Verres in a way of complaint: "Whatever gold, whatever silver, whatever ornaments in my cities, dwellings, temples, whatever right of any kind I possessed by the favour of the senate and people of Rome; you, Verres, have plundered and taken from me." Here is a *prosopopeia*, joined with the verbal figure *anaphora*, as several members of the sentence begin with the same word. The like instances of complex figures frequently occur, and therefore we need not multiply examples of them here.

PARTICULAR ELOCUTION,

Or that part of Elocution which considers the several Properties and Ornaments of Language, as they are made use of to form different sorts of Style.

Chap. IV. *Of Style, and its different Characters.*

99 Particular elocution treats of style and its various characters.

The word *style* properly signifies the instrument which the ancients used in writing. For as they commonly wrote upon thine boards covered over with wax, and sometimes upon the barks of trees, they made use of a long instrument like a bodkin, pointed at one end, with which they cut their letters; and broad at the other, to erase any thing they chose to alter. And this the Latins called *stylus.* But though this be the first sense of the word, yet afterwards it came to denote the manner of expression. In which sense we likewise use it, by the same kind of trope that we call any one's writing his *hand.* Style, then, in the common acceptation of the word at present, is the peculiar manner in which a man expresses his conceptions by means of language. It is a picture of the ideas which rise in his mind, and of the order in which they are there produced. As to the reasons which occasion a variety of style, they are principally these.

Since both speech and writing are only sensible expressions of our thoughts, by which we communicate them to others; as all men think more or less differently, so consequently they in some measure differ in their style. No two persons who were to write upon one subject, would make use of all the same words. And were this possible, yet they would as certainly differ in their order and connection, as two painters, who used the same colours in painting the same picture, would necessarily vary their mixtures and disposition of them, in the several gradations of lights and shades. As every painter therefore has something peculiar in his manner, so has every writer in his style. It is from these internal characters, in a good measure, that critics undertake to discover the true authors of anonymous writings, and to show that others are spurious, and not the genuine productions of those whose names they bear; as they judge of the age of such writings from the words and manner of expression which have been in use at different times. And we may often observe in persons a fondness for some particular words or phrases, and a peculiarity in the turn or connection of their sentences, or in their transitions from one thing to another; by which their style may be known, even when they design to conceal it. For these things, through custom and habit, will sometimes drop from them, notwithstanding the greatest caution to prevent it.

There is likewise very often a considerable difference in the style of the same person, in several parts of his life. Young persons, whose invention is quick and lively, commonly run into a pompous and luxuriant style. Their fancy represents the images of things to their mind in a gay and sprightly manner, clothed with a variety of circumstances; and while they endeavour to set off each of these in the brightest and most glittering colours, this renders their style verbose and florid, but weakens the force and strength of it. And therefore, as their imagination gradually cools, and comes under the conduct of a more mature judgment, they find it proper to cut off many superfluities; so that by omitting unnecessary words and circumstances, and by a closer connection of things placed in a stronger light, if their style becomes less swelling and pompous, it is, however, more correct and nervous. But as old age sinks the powers of the mind, chills the imagination, and weakens the judgment; the style, too, in proportion usually grows dry and languid. Critics have observed something of this difference in the writings even of Cicero himself. To be master of a good style, therefore, it seems necessary that a person should be endowed with a vigorous mind and lively fancy, a strong memory, and a good judgment. It is by the imagination that the mind conceives the images of things. If the impressions of those images be clear and distinct, the style will be so too; since language is nothing but a copy of those images first conceived by the mind. But if the images are faint and imperfect, the style will accordingly be flat and languid. This is evident from the difference between such objects as are represented to our sight, and things of which we have only read or heard. For as the former generally make a deeper impression upon our minds, so we can describe them in a more strong and lively

lively manner. And we commonly find, that according as persons are affected themselves when they speak, they are able to affect others with what they say. Now persons are more or less affected with things in proportion to the impressions which the images of those things make upon the mind. For the same reason also, if the imagination be dull, and indisposed to receive the ideas of things, the style will be stiff and heavy; or if the images are irregular and disordered, the style will likewise be perplexed and confused. When things lie straight (as we say) in the mind, we express them with ease, and in their just connection and dependence; but when they are warpt or crooked, we deliver them with pain and difficulty, as well as disorder. A good fancy should likewise be accompanied with a happy memory. This helps us to retain the names of those things the ideas whereof are presented to the mind by the imagination, together with proper and suitable phrases to express them in their several connections and relations to each other. When the images of things offer themselves to the mind, unless the names of them present themselves at the same time, we are at a loss to express them, or at least are in danger of doing it by wrong and improper terms. Besides, variety is necessary in discourse to render it agreeable; and, therefore, without a large furniture of words and phrases, the style will necessarily become insipid and jejune, by the frequent return of the same terms and manner of expression. But to both these a solid judgment is highly requisite to form a just and accurate style. A fruitful imagination will furnish the mind with plenty of ideas, and a good memory will help to clothe them in proper language; but unless they are both under the conduct of reason, they are apt to hurry persons into many inconveniences. Such are generally great talkers, but far from good orators. Fresh images continually crowd in upon them, faster than the tongue can well express them. This runs them into long and tedious discourses, abounding with words, but void of sense. Many impertinences, if not improprieties, necessarily mix themselves with what they say; and they are frequently carried off from their point, by not having their fancies under a proper regulation. So that such discourses, though composed perhaps of pretty expressions, rhetorical flowers, and sprightly sallies of wit, yet fall very much short of a strong and manly eloquence. But where reason presides and holds the reins, every thing is weighed before it is spoken. The properest words are made choice of, which best suit the ideas they are designed to convey; rather than the most gay and pompous. All things are not said which offer themselves to the mind, and fancy dictates; but such only as are fit and proper, and the rest are dropped. Some things are but slightly mentioned, and others discoursed on more largely and fully, according to their different importance. And every thing is placed in that order, and clothed in such a dress, as may represent it to the greatest advantage. So that, in a word, the foundation of a good style is chiefly good sense. Where these qualities all meet in a considerable degree, such persons have the happiness to excel, either in speaking or writing. But this is not generally the case. Many persons of a vigorous and sprightly imagination, have but a weak judgement; and others much more judicious can think but slowly. And it is this, in a great measure, which makes the difference between speaking and writing well, as one or the other of these qualities is predominant. A person of a lively fancy, ready wit, and voluble tongue, will deliver himself off hand much better and more acceptably, than one who is capable, upon due premeditation, to discern farther into the subject, but cannot command his thoughts with the same ease and freedom. And this latter would have the same advantage of the other, were they both coolly to offer their sentiments in writing. Many things appear well in speaking, which will not bear a strict scrutiny. While the hearer's attention is obliged to keep pace with the speaker, he is not at leisure to observe every impropriety or incoherence, but many slips easily escape him, which in reading are presently discovered. Hence it is often found, that discourses, which were thought very fine when heard, appear to have much less beauty, as well as strength, when they come to be read. And therefore it is not without reason, that Cicero recommends to all those who are candidates for eloquence, and desirous to become masters of a good style, to write much. This affords them an opportunity to digest their thoughts, weigh their words and expressions, and give every thing its proper force and evidence; as likewise, by reviewing a discourse when composed, to correct its errors, or supply its defects; till by practice they gain a readiness both to think justly, and to speak with propriety and eloquence. But it is time to proceed to some other causes of the diversity of style.

Different countries have not only a different language, but likewise a peculiarity of style suited to their temper and genius. The eastern nations had a lofty and majestic way of speaking. Their words are full and sonorous, their expressions strong and forcible, and warmed with the most lively and moving figures. This is very evident from the Jewish writings in the Old Testament, in which we find a most agreeable mixture of simplicity and dignity. On the contrary, the style of the more northern languages generally partakes of the chillness of their climate. "There is (says Mr Addison *) a certain coldness and indifference in the phrases of our European languages, when they are compared with the oriental forms of speech. And it happens very luckily, that the Hebrew idioms run into the English tongue with a peculiar grace and beauty. Our language has received innumerable elegancies and improvements from that infusion of Hebraisms, which are derived to it out of the poetical passages in holy writ. They give a force and energy to our expressions, warm and animate our language, and convey our thoughts in more ardent and intense phrases than any that are to be met with in our own tongue. There is something so pathetic in this kind of diction, that it often sets the mind in a flame, and makes our hearts burn within us."

* *Spect.* N° 405.

Again, people of different nations vary in their customs and manners, which occasions a diversity in their style. This was very remarkable in the Attics, Asiatics, and Rhodians, and is often taken notice of by ancient writers. The Athenians, while they continued a free state, were an active, industrious, and frugal people: very polite indeed, and cultivated arts and sciences beyond any other nation: but as they had powerful enemies, and were exceedingly jealous of their liberties, this preserved them from wantonness and luxury. And their way of speaking was agreeable to their conduct; accurate and close, but very full and expressive.

Elocution. pressive. The Asiatics, on the other hand, were more gay, and loose in their manners, devoted to luxury and pleasure: and accordingly they affected a florid and swelling style, filled with redundancies and superfluities of expression. Indeed some of the ancients have attributed this looseness of style to their way of pursuing eloquence at first. For as they were put upon it by conversing with the Greek colonies who settled among them, they suppose, that, in imitating them, before they were masters of the language, they were often obliged to make use of circumlocutions, which afterwards became habitual, and very much weakened the force of their expressions, as it naturally would do. But one would think, if they were put to this necessity at first, when they found its ill effect, they might easily have amended it afterwards, as they grew better acquainted with the Greek language, had they been inclined so to do. The Rhodian style was a medium between the other two; not so concise and expressive as the Attic, nor yet so loose and redundant as the Asiatic. Quintilian says, it had a mixture of its author, and the humour of the people; and like plants set in a foreign soil, degenerated from the Attic purity, but not so wholly as to lose it. They first received it from Æschines, who being worsted in his famous contest with Demosthenes, retired thither, and taught rhetoric, which put them upon the study of eloquence.

The style of the same country likewise very much alters in different ages. Cicero tells us, that the first Latin historians aimed at nothing more than barely to make themselves intelligible, and that with as much brevity as they could. Those who succeeded them advanced a step farther; and gave somewhat a better turn and cadency to their sentences, though still without any dress or ornament. But afterwards, when the Greek language became fashionable at Rome, by copying after their writers, such as Herodotus, Thucydides, Xenophon, and others, they endeavoured to introduce all their beauties into their own tongue, which in Cicero's time was brought to its highest perfection. But it did not long continue in that state. A degeneracy of manners soon altered their taste, and corrupted their language, which Quintilian very much complains of in his time. The case was the same with respect to the Greek tongue; though that had the good fortune to continue its purity much longer than the Latin. Nor can any language be exempt from the common fate of all human productions; which have their beginning, perfection, and decay. Besides, there is a sort of fashion in language, as well as other things; and the generality of people are always fond of running into the mode. Perhaps some one, or a few persons, fall into a manner, which happens to please. This gives them a reputation; and others immediately copy after them, till it generally prevail. Cicero tells us, that the most ancient Greek orators whose writings were extant in his time, such as Pericles, Alcibiades, and others, were subtle, acute, concise, and abounded in sense rather than words. But another set that followed them, of which were Critias, Theramenes, and Lysias, retained the good sense of the former, and at the same time took more care of their style; not leaving it so bare as the former had done, but furnishing it with a better dress. After these came Isocrates, who added all the flowers and beauties of eloquence. And as he had abundance of followers, they applied these ornaments and decorations according to their different genius: some for pomp and splendour; and others to invigorate their style, and give it the greater force and energy. And in this latter way Demosthenes principally excelled. Now as each of these manners had its peculiar beauties, and generally prevailed in different ages, Cicero thinks this could not have happened otherwise than from imitation. And he attributes it to the same cause, that afterwards they sunk into a softer and smoother manner, not less exact and florid, but more cold and lifeless. If we take a view of our own tongue, Chaucer seems to have been the first who made any considerable atttempts to cultivate it. And whoever looks into his writings will perceive the difference to be so great from what it is at present, that it scarce appears to be the same language. The gradual improvements it has since received, are very evident in the writers almost of every succeeding age since that time; and how much farther it may still be carried, time only can discover. See LANGUAGE, *passim*: For the English *language* in particular, see N° 38; for the other European languages, as well as the Greek and Latin, see N° 27, &c.

Another cause of the variety of style arises from the different nature and properties of language. A difference in the letters, the make of the words, and the order of them, do all affect the style. So Quintilian observes, that the Latin tongue cannot equal the Greek in pronunciation, because it is harsher. The Latins want two of the softest Greek letters, υ and ζ; and use others of a very hard sound, which the Greeks have not, as *f* and *q*. Again, many Latin words end in *m*; a letter of a broad and hollow sound, which never terminates any Greek word; but ν does frequently, whose sound is much softer and sweeter. Besides, in the combination of syllables the letters *b* and *d* are often so situated, as to require too strong and unequal a force to be laid upon them, as in the words *obversus* and *adjungo*. Another advantage of the Greek tongue arises from the variety and different seat of the accents: for the Greeks often accent the last syllable, which both enlivens the pronunciation, and renders it more musical; whereas the Latins never do this. But the greatest advantage of the Greeks lies in their plenty and variety of words; for which reason they have less occasion for tropes or circumlocutions, which, when used from necessity, have generally less force, and weaken the style. But under these disadvantages, Quintilian seems to give his countrymen the best advice the case will admit of: That what they cannot do in words, they should make up in sense. If their expressions are not so soft and tender, they should exceed in strength; if they are less subtile, they should be more sublime; and if they have fewer proper words, they should excel in the beauty as well as number of their figures. If this account of Quintilian be just, that the Greek tongue does surpass the Latin in all these instances, it is certain that both of them have much greater advantages over some modern languages. The varying all their declinable words, both nouns and verbs, by terminations, and not by signs, contributes very much to the smoothness and harmony of their periods. Whereas in the modern languages, those small particles and pronouns which distinguish the cases of nouns and the tenses and persons of verbs, hinder the run of a period, and

and render the sound much more rough and uneven. Besides, the ancient languages seem to have a better and more equal mixture of vowels and consonants, which makes their pronunciation more easy and musical.

But the chief distinction of style arises from the different subjects or matter of discourse. The same way of speaking no more suits all subjects, than the same garment would all persons. A prince and a peasant ought not to have the same dress; and another different from both becomes those of a middle station in life. The style therefore should always be adapted to the nature of the subject, which rhetoricians have reduced to three ranks or degrees; the *low* or *plain* style, the *middle* or *temperate*, and the *lofty* or *sublime:* Which are likewise called *characters*, because they denote the quality of the subject upon which they treat. This division of style into three characters, was taken notice of very early by ancient writers. Some have observed it even in Homer, who seems to assign the *sublime* or magnificent to Ulysses, when he represents him as so copious and vehement an orator, that his words came from him *like winter snow*. On the contrary, he describes Menelaus as a *polite* speaker, but *concise* and *moderate*. And when he mentions Nestor, he represents his manner as between these two, not so high and lofty as the one, nor yet so low and depressed as the other; but smooth, even, and pleasant, or, as he expresses it, *more sweet than honey*. Quintilian observes, that although accuracy and politeness were general characters of the Attic writers; yet among their orators, Lysias excelled in the *low and familiar* way; Isocrates for his *elegancy, smoothness*, and the *fine turn of his periods;* and Demosthenes for his *flame and rapidity*, by which he carried all before him. And Gellius tells us, that the like difference was found in the three philosophers who were sent from the Athenians to Rome (before the Romans had any relish for the polite arts) to solicit the remittance of a fine laid upon them for an injury done to a neighbouring state. Carneades, one of those ambassadors, was *vehement and rapid* in his harangues; Critolaus, *neat and smooth;* and Diogenes, *modest and sober*. The eloquence of these orators, and the agreeable variety of their different manner, so captivated the Roman youth, and inflamed them with a love of the Grecian arts, that old Cato, who did all he could to check it by hurrying away the ambassadors, could not prevent their vigorous pursuit of them, till the study became in a manner universal. And the old gentleman afterwards learned the Greek language himself, when it became more fashionable. Which a noble writer of ours * represents as *a punishment upon him for his former crime*. It seldom happens that the same person excels in each of these characters. They seem to require a different genius, and most people are naturally led to one of them more than another: though all of them are requisite for an orator upon different occasions, as we shall show hereafter.

* *Lord Bacon.*

Chap. V. *Of the Low Style.*

100 The low style considered both as to thoughts and language.

This we shall consider under two heads, *thoughts* and *language;* in each of which the several characters are distinguished from one another.

I. And with respect to the former, as the subjects proper for this style are either common things, or such as should be treated in a plain and familiar way; so plain thoughts are most suitable to it, and distinguish it from the other characters. 101

Now, by plain thoughts, are meant such as are simple and obvious, and seem to rise naturally from the subject, when duly considered; so that any one, upon first hearing them, would be apt to imagine they must have occurred to himself. Not that this is really the case, but because the more natural a thing is, the more easy it seems to be; though in reality it is often otherwise; and the perfection of art lies in its nearest resemblance to nature. And therefore, in order to speak plainly and clearly upon any subject, it must first be duly considered, well understood, and thoroughly digested in the mind; which, though it require labour and study, yet the more a person is master of what he says, the less that labour will appear in his discourse. This natural plainness and simplicity, without any disguise or affectation, very much contributes to give credit to what is said. Nor is any thing more apt to impose on us, than the appearance of this, when artfully assumed. Cicero's account of the fight between Milo and Clodius, in which Clodius was killed, is a remarkable instance of this. "When Clodius knew (says he) that Milo was obliged to go to Lanuvium upon a solemn and necessary occasion, he immediately hastened from Rome, the day before, to assassinate him before Clodius's own house, as appeared afterwards by the event. And this he did at a time, when his turbulent mob in the city wanted his assistance; whom he would not have left but for the advantage of that place and season to execute his wicked design. But the next day Milo was in the senate, where he continued till they broke up; then went home; changed his dress; staid there some time till his wife was ready; and afterwards set forward so late, that if Clodius had designed to return to Rome that day, he might have been here by that time. Clodius, prepared for his design, met him on horseback, having no chariot, no equipage, no Greek attendants as usual; and without his wife, which was scarcely ever known: whereas Milo was in a chariot with his wife, wrapt up in a cloak, and attended by a large retinue of maid servants, pages, and other persons unfit for an engagement. He met with Clodius before his house, about five o'clock in the evening; and was presently assaulted from a higher ground by many armed men, who killed the coachman. Upon which, Milo, throwing off his cloak, leaped out of the chariot, and bravely defended himself: and those who were with Clodius, having their swords drawn, some made up to the chariot to attack Milo; and others, who now thought he had been killed, began to fall upon his servants who were behind. And of these, such as had courage, and were faithful to their master, some were killed; and others when they saw the skirmish at the chariot, and could do their master no service (for they heard Clodius himself say that Milo was killed, and really thought it was so), did that, not by their master's order, nor with his knowledge, nor when he was present, which every one would have his own servants to do in the like circumstances. I do not say this to fix any crime upon them, but only to relate what happened." His meaning is, they killed Clodius; which he avoids mentioning, to render what he says less offensive. Can any thing be told in a more plain and simple manner than this? Here is nothing said, but

Elocution. what in itself seems highly probable, and what one would imagine the fact might easily suggest to any ordinary spectator. But in this, both the art and skill of it consist. For in the whole account, as, on the one hand, Milo is so described as to render it highly improbable he could have any design at that time against Clodius; so on the other, no one circumstance is omitted which might seem proper to persuade the hearers that Clodius was the aggressor in that engagement. And yet, if we may believe Asconius, the quarrel was begun by some of Milo's retinue, and Clodius was afterwards killed by his express order. But as things are sometimes best illustrated by their opposites, we shall here produce a contrary instance of a very affected and unnatural way of relating a fact. Val. Maximus tells us of a learned man at Athens, who, by a blow which he received by a stone upon his head, entirely forgot all his learning, though he continued to remember every thing else. And therefore, as he says, since this misfortune deprived him of the greatest enjoyment of his life, it had been happier for him never to have been learned, than afterwards to lose that pleasure. This is the plain sense of the story. But now let us hear him relate it, "A man (says he) of great learning at Athens, having received a blow upon his head by a stone, retained the memory of all other things very perfectly, and only forgot his learning, to which he had chiefly devoted himself. The direful and malignant wound invading his mind, and as it were designedly surveying the knowledge reposited there, cruelly seized on that part of it in particular from which he received the greatest pleasure, and buried the singular learning of the man with an invidious funeral. Who since he was not permitted to enjoy his studies, had better never have obtained access to them, than afterwards to have been deprived of the delight they afforded him." What an unnatural way is this of relating such an accident, to talk of *a wound invading the mind*, and *surveying the knowledge reposited there*, and *cruelly seizing a particular part of it*, and *burying it with an invidious funeral*? There is nothing in the story could lead him to this, but an over-fondness to refine upon it in a very affected manner. But there are two properties of plain thoughts, one of which ought constantly to attend them in common with all thoughts, and the other is often necessary to animate and enliven this character.

The former of these is justness and propriety, which is what reason dictates in all cases. What Cicero says of the death of Crassus the orator, seems very just, as well as natural. "It was (says he) an affliction to his friends, a loss to his country, and a concern to all good men; but such public calamities followed upon it, that heaven seemed rather to have favoured him with death, than to have deprived him of life." This thought seems very just, and agreeable to the sentiments of a good man, as Crassus was; to choose death rather than to outlive the happiness of his country, to which he himself had so much contributed. Quintilian has a reflection upon a like occasion, which is not so just and becoming. It is upon the death of his only son, a youth of very uncommon parts, as he represents him; and for whose use he had designed his *Institutions of oratory*: but he died before they were finished. The passage is this: "I have lost him of whom I had formed the greatest hopes, and in whom I had reposed the greatest comfort of my old age. What can I do now? or of what farther use can I think myself to be, thus disappointed by heaven? What good parent will pardon me, if I can any longer study, and not condemn such resolution, if, thus surviving all my family, I can make any other use of my voice, than to accuse the gods, and declare that providence does not govern the world?" Allowance may be made for the sallies of passion, even in wise men, upon some shocking occasions; but when it proceeds to such a degree as to become impious, it is very indecent, as well as unjust. And all indecency is unnatural, as it is disagreeable to reason, which always directs to a decorum. That seems to be a very natural as well as just thought of Pliny the Younger, when he says, "The death of those persons always appears to me too hasty and unseasonable, who are preparing some lasting work. For persons wholly devoted to pleasures, live, as it were, from day to day, and daily finish the end for which they live; but those who have a view to posterity, and preserve their memory by their labours, always die untimely, because they leave something unfinished." We shall mention but one more instance; and that in a comparative view, to make it the more evident. The two sons of Junius Brutus, the first Roman consul, having been convicted of treason, in associating with Tarquin's party, were ordered, among others, to be put to death; and their father not only pronounced the sentence, but presided at the execution. This fact is mentioned by several of the Roman historians; and, as it carries in it not only the appearance of rigorous justice, but likewise of cruelty in Brutus, to have been present at the execution of his sons, they endeavour to vindicate him different ways. What Florus says seems rather an affectation of wit, than a just defence of the fact. "He beheaded them (says he), that being a public parent, he might appear to have adopted the whole body of the people." Nor does Val. Maximus come up to the case, who says, "He put off the father to act the consul; and chose rather to lose the sons, than be wanting to public justice." This might be a reason for condemning them; and would have been equally true, had he not been present at their execution. But Livy, whose thoughts are generally very just and natural, assigns the best reason which perhaps can be given for his vindication, when he says, "Fortune made him the executioner of the sentence, who ought not to have been a spectator." By saying *fortune made him* so, he represents it not as a matter of choice, like the other historians, but of necessity, from the nature of his office, which then obliged him to see the execution of that sentence he had himself before pronounced; as is the custom at present, in some popular governments.

The other property, which should often accompany plain and simple thoughts, is, that they be gay and sprightly. This, as has been said, is necessary to animate and enliven such discourses as require the low style. The fewer ornaments it admits of, the greater spirit and vivacity is requisite to prevent its being dry and jejune. A thought may be very brisk and lively, and at the same time appear very natural, as the effect of a ready and flowing wit. Such thoughts, attended with agreeable turns, are very suitable to this style; but care should be taken, lest, while fancy is too much indulged, the justness of them be overlooked. We shall give one instance, in which this seems to have been the case,

case, from a celebrated English work, where the ingenious writer endeavours to show the disadvantages of persons not attending to their natural genius, but affecting to imitate others in those things for which they were not formed. "The great misfortune (says he) of this affectation is, that men not only lose a good quality, but also contract a bad one; they not only are unfit for what they are designed, but they assign themselves to what they are unfit for; and instead of making a very good figure one way, make a very ridiculous one another. Could the world be reformed to the obedience of that famed dictate, *Follow nature*, which the oracle of Delphos pronounced to Cicero when he consulted what course of studies he should pursue, we should see almost every man as eminent in his proper sphere as Tully was in his. For my part, I could never consider this preposterous repugnancy to nature any otherwise, than not only as the greatest folly, but also one of the most heinous crimes; since it is a direct opposition to the disposition of providence, and (as Tully expresses it) like the sin of the giants, an actual rebellion against heaven." The advantages that arise from persons attending to their own genius, and pursuing its dictates, are here represented in a very lively and agreeable manner. But there is one thing asserted, which we fear will not hold; which is, that, *Could the world be reformed to that dictate,* "Follow Nature," *we should see almost every man as eminent in his proper sphere as Tully was in his.* For though doubtless persons would generally succeed best if they kept to this rule; yet different degrees of ability are often found, where the bias and inclination is the same, and that accompanied with equal labour and diligence. If this was not so, how happened it that no one came up to Tully in the art of oratory; especially in his own age, when there were the greatest opportunities for that study, and the highest encouragements were given to it, as it paved the way to riches, honours, and all the grand offices of the state? It cannot well be questioned but that there were other gentlemen, who had all the same advantages, accompanied with as strong a passion for this art, as Tully had, who yet fell much short of him in point of success. And experience shows, that the case has been the same in all other pursuits.

102 The language proper for this style.

III. But it is time to proceed to the other head, the *language* proper for this style. And here it may be observed in general, that the dress ought to be agreeable to the thoughts, plain, simple, and unaffected.

But the first thing that comes under consideration is elegance, or a proper choice of words and expressions; which ought always to suit the ideas they are designed to convey. And therefore when an ancient writer, speaking of *cruelty*, calls it *nævus crudelitatis*, the *blemish of cruelty;* and another, applying the same word to *ingratitude*, says *nævus ingratitudinis*, the *blemish of ingratitude;* that term does not sufficiently convey to us the odious nature of either of those vices, as indeed it was not their design it should. But otherwise, where the speaker has not some particular view in doing it, to sink too low is as much a fault as to rise too high. So to call ancient Rome *the mistress of Italy*, would as much lessen the just notion of the extent of her power, as the Roman writers aggrandise it when they style her *mistress of the world*. But purity, both in the choice of words and expressions, is never more necessary than it is here. This may be called *neatness in language*. And to be plain and neat at the same time, is not only very consistent, but the former can no other way recommend itself, than as joined with the latter. Besides, the fewer advantages any thing has to set it off, the more carefully they ought to be observed. Perspicuity is always to be regarded; and serves very much to keep up the attention, where other ornaments are wanting. Epithets should be sparingly used, since they enlarge the images of things, and contribute very much to heighten the style. Indeed they are sometimes necessary to set a thing in its just light; and then they should not be dropped. Thus, in speaking of Xerxes, it would be too low and flat to say, *He descended with his army into Greece.* Here is no intimation given of their vast and unparalleled numbers, which ought to be done. Herodotus says, his whole army, of sea and land forces, amounted to 2,317,000 and upwards. Therefore, unless the number be mentioned, the least that can be said is, that *he descended with a vast army.*

The next thing to be regarded is composition, which here does not require the greatest accuracy and exactness. A seeming negligence is sometimes a beauty in this style, as it appears more natural. Short sentences, or those of a moderate length, are likewise upon the whole best suited to this character. Long and accurate periods, finely wrought up with a gradual rise, harmonious numbers, a due proportion of the several parts, and a just cadency, are therefore improper, as they are plainly the effect of art. But yet some proportion should be observed in the members, that neither the ears be too much defrauded, nor the sense obscured. Of this kind is that expression of a Greek orator, blamed by Demetrius: *Ceres came readily to our assistance, but Aristides not.* The latter member of this sentence is too short; and by dropping so suddenly, both disappoints the ears, and is somewhat obscure. It would have been plainer and more agreeable thus, *but Aristides did not come.* As to order, the plainest and clearest disposition, both of the words and members of sentences, and what is most agreeable to the natural construction, best suits with this character. For one of its principal beauties is perspicuity. And a proper connection likewise of sentences, with a regular order in the dependence of things one upon another, very much contributes to this end. With regard to the collision of syllables in different words, for preventing either a hollowness or asperity of sound, greater liberty may be taken in this style than in the other characters. Here it may be allowed to say, *Virtue is amiable to all, though all do not pursue it.* But in a higher character, perhaps, in order to prevent the hollow sound of the words *though all*, a person would choose to vary the expression a little, and say, *though few pursue it.* So, *Xerxes' expedition*, may be tolerable here; but in the florid style, *the expedition of Xerxes* would sound much better.

The last thing to be considered, with respect to the language is dignity, or the use of tropes and figures. And as to tropes, they ought to be used cautiously; unless such as are very common, and by time have either come into the place of proper words, or at least are equally plain and clear. So in the instance mentioned above, Diodorus Siculus, speaking of the forces of Xerxes, calls them an *innumerable company*. Where, by

Elocution. by a *synecdoche*, he has chosen to make use of an uncertain number for a certain, as less liable perhaps to exception. Other examples might be given if necessary. And with regard to figures, as most of those which consist in words, and are therefore called *verbal figures*, serve chiefly to enliven an expression, and give an agreeable turn, they are often not improper for this character. Nor are figures of sentences wholly to be excluded, especially such as are chiefly used in reasoning or demonstration. But those which are more peculiarly adapted to touch the passions, or paint things in the strongest colours, are the more proper ornaments of the higher styles, as will be shown hereafter.

Upon the whole, therefore, pure nature, without any colouring, or appearance of art, is the distinguishing mark of the low style. The design of it is to make things plain and intelligible, and to set them in an easy light. And therefore the proper subjects of it are epistles, dialogues, philosophical dissertations, or any other discourses, that ought to be treated in a plain and familiar manner, without much ornament, or address to the passions. A freedom and ease both of thought and expression, attended with an agreeable humour and pleasantry, are its peculiar beauties that engage us. As we see persons of fashion and good breeding, though in the plainest habit, have yet something in their air and manner of behaviour that is very taking and amiable. Somewhat of the like nature attends this style. It has its difficulties, which are not so easily discerned but from experience. For it requires no small skill to treat a common subject in such a manner as to make it entertaining. The fewer ornaments it admits of, the greater art is necessary to attain this end. Lofty subjects often engage and captivate the mind by the sublimity of the ideas. And the florid style calls in all the assistance of language and eloquence. But the plain style is in a great measure stripped of those advantages; and has little more to recommend it, than its own native beauty and simplicity.

Chap. VI. *Of the Middle Style.*

103 This we shall treat in the same manner as we did the former, by considering first the *matter*, and then the *language* proper for it.

104 The middle style considered as to matter and language.

I. And as the subjects proper for this style are things of weight and importance, which require both a gravity and accuracy of expression; so fine thoughts are its distinguishing mark, as plain thoughts are of the low character, and lofty thoughts of the sublime. Now a fine thought may deserve that character from some or other of the following properties.

And the first property we shall mention is gravity and dignity. Thus Cicero in a speech to Cæsar, says, "It has been often told me, that you have frequently said, you have lived long enough for yourself. I believe it, if you either lived, or was born for yourself only." Nothing could either be more fit and proper, than this was, when it was spoken; or at the same time a finer compliment upon Cæsar. For the civil war was now over, and the whole power of the Roman government in the hands of Cæsar; so that he might venture to say he had lived long enough for himself, there being no higher pitch of glory to which his ambition could aspire. But then there were many things in the state that wanted redressing, after those times of disorder and confusion, which he had not yet been able to effect, and of which Cicero here takes an opportunity to remind him. We shall produce another example from Curtius. Philotas, one of Alexander's captains, having formed a conspiracy against him, was convicted of it, and put to death. Amintas, who was suspected of the same crime, by reason of his great intimacy with Philotas, when he comes to make his defence, among other things speaks thus: "I am so far from denying my intimacy with Philotas, that I own I courted his friendship. Do you wonder that we showed a regard to the son of Parmenio, whom you would have to be next to yourself, giving him the preference to all your other friends? You, Sir, if I may be allowed to speak the truth, have brought me into this danger. For to whom else is it owing, that those who endeavoured to please you, addressed themselves to Philotas? By his recommendation we have been raised to this share of your friendship. Such was his interest with you, that we courted his favour, and feared his displeasure. Did we not all in a manner engage ourselves by oath, to have the same friends, and the same enemies, which you had? Should we have refused to take this, which you, as it were, proposed to us? Therefore, if this be a crime, you have few innocent persons about you; nay, indeed none. For all desired to be the friends of Philotas; though all could not be so who desired it. Therefore, if you make no difference between his friends and accomplices, neither ought you to make any between those who desire to be his friends, and those who really were so." Could any thing be finer spoken, more proper, and becoming the character of a soldier, than this defence; especially to a prince of so great and generous a spirit as Alexander? There is something which appears like this in Tacitus with relation to the emperor Tiberius, but falls vastly short of it in the justness and dignity of the sentiment. Sejanus, his great favourite, and partner in his crimes, falling under his displeasure, was, like Philotas, put to death for a conspiracy. Now a Roman knight, who apprehended himself in danger on account of his friendship with Sejanus, thus apologizes for himself to the emperor, in the manner of Amintas: "It is not for us to examine the merit of a person whom you raise above others, nor your reasons for doing it. The gods have given you the sovereign power of all things, to us the glory of obeying. Let conspiracies formed against the state, or the life of the emperor, be punished; but as to friendships and private regards, the same reason that justifies you, Cæsar, renders us innocent." The turn of the expressions is not much different from that in the case of Amintas; but the beauty of the thought is spoiled by the flattery of complimenting Tiberius upon an excess of power, which he employed to the destruction of many excellent men. There is not that impropriety in the defence of Amintas, which is equally brave and just.

Another property of a fine thought is *beauty* and *elegance*. It is a fine compliment which Pliny pays to the emperor Trajan, when he says, "It has happened to you alone, that you was father of your country, before you was made so." Some of the Roman emperors had been complimented with the title of *father of their country*, who little deserved it. But Trajan had a long time refused it, though he was really so, both by his goo-

Elocution. good government, and in the esteem of his subjects, before he thought fit to accept of it. And Pliny, among other instances of the generosity of that prince, which he mentions in the same discourse, speaking of the liberty that he gave the Romans to purchase estates which had belonged to the emperors, and the peaceable possession they had of them, does it by a turn of thought no less beautiful than the former. "Such (says he) is the prince's bounty, such the security of the times, that he thinks us worthy to enjoy what has been possessed by emperors; and we are not afraid to be thought so." There is a sprightliness in this image, which gives it a beauty; as there is likewise in the following passage of the same discourse, where he says to Trajan, "Your life is displeasing to you, if it be not joined with the public safety; and you suffer us to wish you nothing but what is for the good of those who wish it." And of the same kind is that of Cicero to Cæsar, when he says, "You, Cæsar, are wont to forget nothing but injuries." It is a very handsome, as well as just reflection, made by Tacitus upon Galba's government, that "He seemed too great for a private man, while he was but a private man; and all would have thought him worthy of the empire, had he never been emperor." The beauty of a thought may give us delight, though the subject be sorrowful; and the images of things in themselves unpleasant may be so represented as to become agreeable. Sisigambis, the mother of Darius, after the death of her son, had been treated by Alexander with the greatest regard and tenderness, in whose power she then was. So soon as she heard therefore that he was dead, she grew weary of life, and could not bear to outlive him. Upon which Q. Curtius makes this fine reflection: "Though she had courage to survive Darius, yet she was ashamed to outlive Alexander."

The next property of a fine thought, which we shall mention, is *delicacy*. As, in the objects of our senses, those things are said to be delicate which affect us gradually in a soft and agreeable manner; so a delicate thought is that which is not wholly discovered at once, but by degrees opening and unfolding itself to the mind, discloses more than was at first perceived. Quintilian seems to refer to this, when he says, "Those things are grateful to the hearers, which, when they apprehend, they are delighted with their own sagacity; and please themselves, as though they had not heard, but discovered them." Such thoughts are not unlike the sketches of some pictures, which let us into the design of the artist, and help us to discern more than the lines themselves express. Of this kind is that of Sallust: "In the greatest fortunes, there is the least liberty." This is not often so in fact, but ought to be; both to guard against an abuse of power, and to prevent the effects of a bad example to inferiors. Pliny, speaking of the emperor Trajan's entry into Rome, says, "Some declared, upon seeing you, they had lived long enough; others, that now they were more desirous to live." The compliment is fine either way, since both must esteem the sight of him the greatest happiness in life; and in that consistency lies the delicacy of the thought. It was a fine character given of Grotius, when very young, on the account of his surprising genius and uncommon proficiency in learning, that *he was born a man:* As if nature, at his coming into the world, had at once furnished him with those endowments which others gradually acquire by study and application. Elocution.

The last property of a fine thought, which we shall take notice of, is *novelty*. Mankind is naturally pleased with new things; and when at the same time they are set in an agreeable light, this very much heightens the pleasure. Indeed there are few subjects, but what have been so often considered, that it is not to be expected they should afford many thoughts entirely new; but the same thought set in a different light, or applied to a different occasion, has in some degree a claim of novelty. And even where a thing hath been so well said already, that it cannot easily be mended, the revival of a fine thought often affords a pleasure and entertainment to the mind, though it can have no longer the claim of novelty. Cicero, in his treatise of an orator, among several other encomiums which he there gives to Crassus, says of him, "Crassus always excelled every other person, but that day he excelled himself." He means as an orator. But elsewhere he applies the same thought to Cæsar, upon another account; and with some addition to it. "You had (says he) before conquered all other conquerors by your equity and clemency, but to-day you have conquered yourself; you seem to have vanquished even victory herself, therefore you alone are truly invincible." This thought, with a little variation of the phrase, has since appeared in several later writers; and it is now grown common to say of a person, who excels in any way, upon his doing better than he did before, that he has outdone himself. The like has happened to another thought, which, with a little alteration, has been variously applied. It was said by Varro, *That if the Muses were to talk Latin, they would talk like Plautus.* The younger Pliny, applying this compliment to a friend of his, says, *His letters are so finely written, that you would think the Muses themselves talked Latin.* And Cicero tells us, *It was said of Xenophon, that the Muses themselves seemed to speak Greek with his voice.* And elsewhere, that *Philosophers say, if Jupiter speaks Greek, he must speak like Plato.* The thought is much the same in all these instances, and has been since revived by some modern writers.

125 The language of the middle style.

II. We shall now consider the *language* proper for the middle style. And in general it may be observed, that as the proper subjects of it are things of weight and importance, though not of that exalted nature as wholly to captivate the mind, and divert it from attending to the diction, so all the ornaments of speech, and beauties of eloquence, have place here.

And first with regard to elegance, it is plain that a different choice of words makes a very great difference in the style, where the sense is the same. Sometimes one single word adds a grace and weight to an expression, which, if removed, the sense becomes flat and lifeless. Now such words as are most full and expressive suit best with his character. Epithets also, which are proper and well chosen, serve very much to beautify and enliven it, as they enlarge the ideas of things, and set them in a fuller light.

The most accurate composition, in all the parts of it, has place here. Periods, the most beautiful and harmonious, of a due length, and wrought up with the most exact order, just cadency, easy and smooth connec-tion.

tion of the words, and flowing numbers, are the genuine ornaments, which greatly contribute to form this character.

But the principal distinction of style arises from tropes and figures. By these it is chiefly animated and raised to its different degrees or characters, as it receives a lesser or greater number of them; and those either more mild, or strong and powerful.

As to tropes, those which afford the most lively and pleasing ideas, especially metaphors, suit the middle character. It is a pretty remark, which has been made by some critics upon two verses of Virgil; one in his Eclogues, and the other in his Georgics. The former of these works is for the most part written in the low style, as the language of shepherds ought to be; but the latter in the middle style, suitable to the nature of the subject, and the persons for whom it was designed, the greatest men in Rome not thinking it below them to entertain themselves with rural affairs. Now in the Eclogue, as some copies read the verse, the shepherd, complaining of the barrenness of his land, says,

Infelix lolium et steriles nascuntur avenæ.

In English thus:

Wild oats and darnel grow instead of corn.

But in the Georgic, where the same sense is intended, instead of the proper word *nascuntur*, *grow*, the author substitutes a metaphor, *dominantur*, *command*, and says,

Infelix lolium et steriles dominantur avenæ.

That is in English;

Where corn is sown, darnel and oats command.

It was fit and natural for the shepherd to express his sense in the plainest terms; and it would have been wrong to represent him going so far out of his way, as to fetch a metaphor from government, in talking upon his own affairs. But in the Georgic, where the poet speaks in his own person, the metaphor is much more beautiful, and agreeable to the dignity of the work. This instance may show in some measure how the style is heightened by tropes, and the same thought may be accommodated to the several characters of style by the different manner of expression.

The like may also be said of figures either of words or sentences, in reference to this character; which admits of the finest descriptions, most lively images, and brightest figures, that serve either for delight, or to influence the passions without transport or ecstasy, which is the property of the sublime. This is indeed the proper seat of such embellishments, which support and make up a principal part of the middle or florid style. Having treated largely upon these in several preceding chapters, we shall here only briefly mention some of the most considerable.

106 Descriptions ornamental and pleasant.

Descriptions are not only a great ornament to a discourse, but represent things in a very lively and agreeable manner. In what a beautiful light has Cicero placed the polite arts and sciences, when, describing them from their effects, he thus represents to us the great advantages, as well as pleasure, which they afford to the mind? "Other studies neither suit with all times, nor all ages, nor all places; but these improve youth, delight old age, adorn prosperity, afford a refuge and solace in adversity; please at home, are no hinderance abroad; sleep, travel, and retire, with us." And they often affect us very powerfully, when they are addressed to the senses. Quintilian has painted the calamities of a city taken by storm in the brightest and strongest colours, which he represents by "Flames spreading themselves over the houses and temples, the cracking of falling buildings, and a confused noise from a variety of cries and shouts; some running they know not where, others in the last embraces of their friends; the shrieks of children, women, and old men unhappily reserved to such distress; the plundering of all places civil and sacred, the hurry and confusion in carrying off the booty, captives driven before their victors, mothers endeavouring to guard their infants, and quarrels among the conquerors where the plunder is largest." This seems to be a very natural, as well as moving, image of so dreadful a calamity.

107 Prosopopeia well fitted for this character.

Prosopopeia is another very strong and beautiful figure, very proper for this character. Seneca has a fine instance of it in his "Consolatory Letter to Marcia," upon the death of her son. After many arguments he had made use of to alleviate her grief, he at last introduces her father, Cremutius Cordus, as thus addressing to her: "Imagine your father (says he) from the celestial regions, speaking to you in this manner: Daughter, why do you so long indulge your grief? why are you so ignorant, as to think it unhappy for your son, that, weary of life, he has withdrawn himself to his ancestors? Are you not sensible what disorders fortune occasions everywhere? and that she is kindest to those who have least concern with her? Need I mention to you princes who had been extremely happy, had a more timely death secured them from impending evil? or Roman generals, who wanted nothing to consummate their glory but that they lived too long? Why then is he bewailed longest in our family who died most happily! There is nothing, as you imagine, desirable among you, nothing great, nothing noble; but, on the contrary, all things are mean, full of trouble and anxiety, and partake very little of the light which we enjoy." This advice was very suitable for a philosopher; and he seems to have chosen this way of introducing it, to enforce the argument drawn from the happiness of good men in a future state, from the testimony of a person who was actually in the possession of it.

108 Similitudes both ornamental and frequent here.

Similitudes and comparisons are another great ornament of this style, and oftenest found here. Nothing can be finer than the comparison between those two great orators, Demosthenes and Cicero, made by Quintilian, when he says, "Demosthenes and Cicero differ in their elocution; one is more close, and the other more copious; the former concludes more concisely, and the latter takes a larger compass; the one always with pungency, and the other generally with weight; one can have nothing taken from him, and the other nothing added to him; the latter has more of art, and the former more of nature. But this must be allowed to Demosthenes, that he made Cicero in a great measure what he was. For as Tully gave himself wholly to an imitation of the Greeks, he seems to me to have expressed the force of Demosthenes, the fluency of Plato, and the pleasantry of Isocrates." Similitudes, taken from natural things, serve very much to enliven the style, and

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and give it a cheerfulness; which is a thing so common and well known, that we need not stay to give any instances of it.

109 Antithesis, has also a fine effect.

Antithesis, or opposition both in the words and sense, has often the like beautiful effect. There is an agreeable contrast in that passage of Seneca: "Cæsar does not allow himself many things, because he can do all things: his watching defends all others sleep, his labour their quiet, his industry their pleasure, his business their ease; since he has governed the world he has deprived himself of it." Had he said no more than only in general, that *Cæsar does not allow himself many things, because he can do all things*, it might have passed for a fine thought; but, by adding so many particulars, all in the same form of expression, and beginning each member with the same word, he has both enlarged the idea, and beautified the antithesis, by a bright verbal figure.

These, and such like florid figures, are sometimes found in historians, but oftener in orators; and indeed this middle character, in the whole of it, is best accommodated to the subjects of history and oratory.

Chap. VII. *Of the Sublime Style.*

110 The noblest and the most difficult part of an orator's province is the sublime.

The *sublime* is the most noble, as well as the most difficult, part of an orator's province. It is this principally which Cicero requires in his perfect orator, whom he could not describe in words, but only conceive of in his mind. And indeed, the noblest genius and greatest art are both requisite to form this character. For where nature has been most liberal in furnishing the mind with lofty thoughts, bright images, and strong expressions; yet without the assistance of art there will sometimes be found a mixture of what is low, improper, or misplaced. And a great genius, like a too rich soil, must produce flowers and weeds promiscuously, without cultivation. But the justest propriety, joined with the greatest strength and highest elevation of thought, are required to complete the true sublime. Art, therefore, is necessary to regulate and perfect the taste of those who are desirous to excel in this character.

In explaining the nature and properties of this character, we shall, as in the two former, consider first the *thoughts*, and then the *language*, in each of which it is distinguished from them.

§ 1. *Sublime, as it relates to Thoughts.*

111 Sublimity as it relates to thoughts.

Lofty and grand sentiments are the basis and foundation of the true sublime. Longinus therefore advises those who aspire at this excellence, to accustom themselves to think upon the noblest subjects. A mind that always dwells upon low and common subjects can never raise itself sufficiently to represent things great and magnificent in their full extent and proper light. But he who inures himself to conceive the highest and most exalted ideas, and renders them familiar to his thoughts, will not often be at a loss how to express them; for where proper words are wanting, by metaphors and images taken from other things, he will be able to convey them in a just and adequate manner. What is more common than for two persons to conceive very differently of the same thing from the different manner of thinking to which they have been accustomed? After the great battle in Cilicia, between Alexander and Darius, in which the latter was routed, he sent ambassadors to Alexander with proposals of peace, offering him half his kingdom with his daughter in marriage. Parmenio, one of Alexander's chief captains, says to him upon this occasion, "For my part, was I Alexander, I would accept of these conditions." "And so would I (replies that aspiring monarch), was I Parmenio." The half of so vast a kingdom at present, and a right of succession to the whole by marriage, was the highest ambition to which the thoughts of Parmenio could rise. But Alexander had vastly higher views; he aimed at nothing less than universal monarchy; and therefore such a proposal seemed much beneath his regard. Noble and lofty thoughts are principally those which either relate to divine objects, or such things as among men are generally esteemed the greatest and most illustrious.

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Of the former sort is that of Homer, when describing the goddess Discord, he says, that she

Walks on the ground, and hides her head in clouds.

This stretch of thought, says Longinius, as great as the distance between heaven and earth, does not more represent the stature of the goddess, than the measure of the poet's genius and capacity. But such images, however beautiful in poetry, are not so proper for an orator, whose business it is to make choice of those which are suited to the nature of things and the common reason of mankind. When Numa the second king of Rome was settled in his government, and at peace with his neighbours, in order to soften the fierce and martial temper of his subjects, who had been always accustomed to war during the reign of his predecessor Romulus, he endeavoured to impress their minds with an awe of the Deity; and for that end introduced a number of religious ceremonies, which he pretended to have received from the goddess Egeria *. This must be esteemed an artful piece of policy at that time. But that sentiment is far more just and noble, with which Cicero endeavours to inspire the members of a community, in his treatise of Laws, when he says, that "Citizens ought first to be persuaded, that all things are under the rule and government of the gods; that every affair is directed by their wisdom and power; that the highest regard is due to them from men, since they observe every one's conduct, how he acts and behaves himself, and with what temper and devotion he worships them; and that they make a difference between the pious and impious." Persons under the influence of such a persuasion, could not fail of behaving well in society. And what he says to Cæsar is no less in this style, when, interceding for Ligarius, he tells him, that "men in nothing approach nearer to deity, than in giving life to men." And Velleius Paterculus, speaking of Cato, gives him this sublime character, "That he was more like the gods than men; who never did a good thing, that he might seem to do it."

* See Egeria.

The other kind of lofty thoughts mentioned above, are those which relate to power, wisdom, courage, beneficence, and such other things as are of the highest esteem among mankind. "Your fortune (says Tully to Cæsar) has nothing greater than a power, nor your nature

nature than a will, to save many." He subjoins this compliment to what we have just cited from him; and applies that to Cæsar, which was before only expressed in general, leaving him to draw the inference of his similitude to deity from the clemency of his nature. And elsewhere, as in a sort of transport for his success in defeating the conspiracy of Catiline, he thus bespeaks the Roman senate: "You have always decreed public thanks to others for their good government of the state, but to me alone for its preservation. Let that Scipio shine, by whose conduct and valour Hannibal was forced to leave Italy, and retire to Africa; let the other Scipio be greatly honoured, who destroyed Carthage and Numantia, two cities the most dangerous to this empire; let Lucius Paulus be in high esteem, whose triumphal chariot was adorned with Perses, once a most powerful and noble prince; let Marius be in eternal honour, who twice delivered Italy from an invasion and the dread of servitude; let Pompey's name excel all these, whose actions and virtues are terminated by no other bounds but the course of the sun;—yet among all their praises, there will still some place be left for my glory; unless indeed it be a greater thing to open for us new provinces to which we may resort, than to secure a place for our victorious generals to return in triumph." And Velleius Paterculus, as if he thought no encomium too high for this great orator, laments his unhappy fate in these lofty strains, addressed to M. Antony, by whose order he was put to death: "You have taken from Cicero old age, and a life more miserable than death under your government; but his fame, and the glory of his actions and words, you have been so far from destroying, that you have increased them. He lives, and will live in the memory of all ages; and while this system of nature, however constituted, shall remain (which scarce any Roman but himself conceived in his mind, comprehended by his genius, and illustrated with his eloquence), the praise of Cicero shall accompany it; and all posterity, while it admires his writings against you, will curse your treatment of him; and sooner shall mankind be lost to the world than his name." It was a noble reply of Porus the Indian king, when, after his defeat by Alexander, being brought before him, and asked *How he expected to be treated?* he answered, *Like a king.* And Valerius Maximus, speaking of Pompey's treatment of Tigranes king of Armenia after he had vanquished him, expresses it in a manner suited to the dignity and beneficence of the action, when he says, "He restored him to his former fortune, esteeming it as glorious to make kings as to conquer them."

But the true sublime is consistent with the greatest plainness and simplicity of expression. And, generally speaking, the more plain and natural the images appear, the more they surprise us. How succinct, and yet how majestic, is that expression of Cæsar upon his victory over Pharnaces? *I came, I saw, I conquered.* But there cannot be a greater or more beautiful example of this, than what Longinus has taken notice of from Moses. "The legislator of the Jews (says he), no ordinary person, having a just notion of the power and majesty of the Deity, has expressed it in the beginning of his laws in the following words: *And God said*—what? *Let there be light*; *and there was light. Let the earth be made*; *and it was made.*" This instance from the divine writer, and the character here given of him by that excellent critic, is the more remarkable, as he was himself a Pagan. And certainly no laboured description could raise in the mind a higher conception of the infinite power of the Deity, than this plain and short narration. To command nature itself into being by a *word*, represents it at once altogether boundless and unlimited.

It sometimes very much contributes to heighten the image of a thing, when it is expressed in so undetermined a manner, as to leave the mind in suspense what bounds to fix to the thought. Of this kind is that of Cicero, when he first raises an objection against the necessity of an acquaintance with polite literature in order to form a great man, and then answers it. The objection is founded upon the examples of several great and excellent persons among the Romans, who had raised themselves to the highest pitch of honour and dignity, and been very serviceable to their country, by the help of a good genius, without the advantage of much learning. In reply to which, he allows, that, where these are not united, nature or genius is of itself much preferable, and will carry a person further in the pursuit of great and noble designs, then learning without a genius; but that both are necessary to complete and perfect a truly great man. But we shall give what he says himself on this head, by which that property of a sublime thought we are now endeavouring to explain, will appear from his manner of expression: "I acknowledge (says he) that many persons of an exalted mind and virtue have, from a divine temper, without instruction, become moderate and grave; and I add likewise, that nature, without the assistance of learning, has frequently more contributed to honour and virtue, than learning where a genius has been wanting: But yet I must say, that where the direction and improvement of learning is added to a great and excellent genius, it is wont to produce something admirable and singular which I know not how to describe." He knew very well, that by leaving the minds of his hearers thus in suspense, they would form to themselves higher conceptions of what he intended, than from any idea he could convey to them in words. We may add to this another example from the same great orator, where he says, "Truly, if the mind had no views to posterity, and all its thoughts were terminated by those bounds in which the space of life is confined, it would neither fatigue itself with so great labours, nor be disquieted with so many cares and watchings, nor so often expose itself to death. But there is a certain active principle in every good man, which constantly excites his mind by motives of glory; and reminds him, that the remembrance of his name is not to end with his life, but extend itself to all posterity." Of the like nature is that of Milton, when he describes Satan as flying from hell in quest of our earth, then newly formed. For having represented that his wings failed him in the vast vacuity, he thus describes his fall:

Down he drops
Ten thousand fathom deep; and to this hour
Down had been falling, had not by ill chance
The strong rebuff of some tumultuous cloud,
Instinct with fire and nitre, hurried him
As many miles aloft.

Those

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Those words, by which his fall is expressed,

And to this hour,
Down had been falling,

leave the mind in suspense, and unable to fix any bounds to the vacuity; and by that means raise a greater and more surprising idea of its space than any direct expression could have done. This image is very beautiful where it stands; but so much out of the common way of thinking, as to suit better with an epic poem than the discourse of an orator.

§ 2. *The Sublime, with regard to Language.*

112 Sublimity as to language. What we have to offer upon this subject will come under the three heads of *Elegance*, *Composition*, and *Dignity*; which comprehend all the properties of style.

113 I. *Elegance.* Those words and expressions chiefly contribute to form the sublime, which are most sonorous, and have the greatest splendour, force, and dignity. And they are principally such as these. Long words, when equally expressive, are rather to be chosen than short ones, and especially monosyllables. So to conquer or vanquish an enemy, carries in it a fuller and grander sound, than to beat an enemy. For which reason, likewise, compound words are often preferable to simple ones. So if we say, *Cæsar's army, when he was present, was always invincible;* this manner of expression has more of sublimity in it, than should we say, *Cæsar's army, when he was present, could never be conquered.* But the ancient languages have much the advantage of ours in both these respects; for their words are generally longer, and they are abundantly more happy in their compositions. The use of proper epithets does also in a particular manner contribute to this character. For as they denote the qualities and modes of things, they are as it were short descriptions; so that being joined to their subjects, they often greatly enlarge and heighten their image. Thus when the character of *divine poet* is given to Homer or Virgil, or *prince of orators* to Demosthenes or Cicero, it conveys to the mind a more sublime idea of them, than the bare mention of their name.

114 II. *Composition:* The force of which, as Longinus observes, is so great, that sometimes it creates a kind of sublime where the thoughts themselves are but mean, and gives a certain appearance of grandeur to that which otherwise would seem but common. But composition consists of several parts; the first of which, in the order we have hitherto considered them, is *period.* And here the case is much the same as with animal bodies, which owe their chief excellency to the union and just proportion of their parts. The several members, when separated from each other, lose both that beauty and force, which they have when joined together in a complete body. In like manner, sublimity arises from the several parts of a period so connected, as to give force, as well as beauty, to the whole. The periods therefore in this character should be of a proper length. If they are too short, they lose their just weight and grandeur, and are gone almost before they reach the ear; as, on the contrary, when they are too prolix, they become heavy and unwieldy, and by that means lose their force. But more especially, nothing superfluous ought to be admitted, which very much enervates the force of a sentence. We shall exemplify this in a passage from Herodotus, where he is giving an account of the famous battle at Thermopylæ between the Persians and Lacedæmonians. "Dieneces (says he) the Spartan, being told by a Trachinian, before the engagement with the Medes, that when the barbarians came to shoot their arrows, they would fly so thick as to obscure the light of the sun; he was so far from being terrified at this, that, despising their number, he replied, he "was pleased with what his friend told him, since if the sun was obscured, they should fight in the shade, and not in the sun." The sense here is great and noble, but the sublimity of expression is spoiled in a great measure by those last words, *and not in the sun*, which are wholly superfluous. Cicero was sensible of this, and therefore he omits that member in relating the same story, and says only: "A Spartan, hearing that one of the Persians should say in an insulting manner, that when they came to engage, they should not be able to see the sun, for the multitude of their darts and arrows, replies, Then we shall fight in the shade." By stopping here, he gives the sentence much more life and emphasis. The next thing to be considered in composition, is the order and disposition of the several words and members of a sentence. The different placing but of one or two words will sometimes wholly destroy the grandeur of a sentence, and make it extremely flat. "This public act (says Demosthenes) dispelled the danger which at that time, like a cloud, hung over the city." Let us vary the order a little, and read it thus: "This public act dispelled the danger, which like a cloud hung over the city at that time." What a different turn does the expression receive for the worse! The spirit and majesty of it are entirely lost. And in placing the several parts or members, they ought to be so disposed, that what is most weighty and important should stand last. So Tully says of Catiline, "We ought to return thanks to heaven, that we have so often escaped so odious, so frightful, so dangerous a plague of the state." A thing may be odious and frightful, and yet not dangerous; therefore he puts this in the last place, to give it the greater force, and make the deeper impression. Another thing to be attended to in composition, is the connection of the words with regard to the sound; that the pronunciation, in passing from one to another, may be most agreeable to the ear, and best suited to the nature of the subject. And as this is generally something grand and magnificent, such a contexture of them as will give the greatest force and energy to the expression is most proper for the sublime. Soft and languid sounds are very unsuitable to this character. They soothe and please the ear; but rather sink and depress the mind, than excite it to things great and noble. In this respect, therefore, our tongue, by its multitude of consonants, is more suitable for sublime discourses than some other modern languages, which abound with vowels.

III. The last head to be considered, is the proper use of tropes and figures, which is here so necessary, that the title of *dignity* seems to have been given to this part of elocution, from the assistance it more especially affords to this character. For if, as has been observed from Longinus, compositions will sometimes create a 115

Elocution. a sort of sublimity; this much oftener happens from the force and efficacy of some lively tropes and strong figures.

And as to *tropes*, bright metaphors are peculiarly suited to raise and animate the style. This is manifest from the nature of them, as they consist of contracted similies, reduced to a single word; which, if taken from things lofty and grand, must of consequence give a sublimity to the style. What can suggest to us a greater idea of the valour of Ajax, than Homer's calling him *the bulwark of the Greeks;* or of the Scipios, than when they are styled by Virgil, *the two thunderbolts of war.* A number of those, well chosen, contributes no less to the grandeur than to the beauty of discourse. Hyperbole sometimes gives the same force to an expression, if cautiously used; and so as not to exceed all appearance of truth. But the chief use of it is, where proper words will not express the just idea of the thing designed to be conveyed; and it may seem rather the offspring of necessity than choice. Of this nature is that of Herodotus, when speaking of the Lacedæmonians at Thermopylæ, he says, "They defended themselves with the swords they had left, and even with their hands and teeth, till the barbarians buried them under their arrows." It cannot be supposed strictly true, that so many arrows were thrown at them as to bury them; but having in the former part of the sentence represented their resolute defence in the strongest terms, by saying, that naked and without arms, they engaged armed men with their hands and teeth, the following hyperbole seems not unnatural, and to intimate nothing more than what was necessary to quell such obstinate resolution and courage.

As to *figures*, whether verbal or those which consist in the sense, the nature of this character will easily direct to such as are most proper. But with respect to the latter, poets take greater liberties in the use of them than would be allowed in an orator. As their images are often formed for pleasure and delight, so they carry in them more of rapture and transport. But the orator's use of them being to set things in a stronger and clearer light, they are more sedate and moderate. Besides, an orator scarce ever has occasion for such fictitious images as we often meet with in poetry; though his ought to appear as natural, and its painting as strong and lively. We shall just mention some of the chief of those figures which seem best suited for this purpose; though they are no less suited to the middle style, as has been shown already, when taken from subjects of an inferior nature.

116 1. *Description.* Of this Justin gives us a fine instance, in a speech of King Philip of Macedon, wherein he represents the necessity of falling upon the Romans, who at that time were engaged in a war with Hannibal. "I behold (says he) a cloud of a most dreadful and bloody war rising in Italy. I see a storm of thunder and lightning from the west, which will overspread all places with a vast shower of blood, into whatever country the tempest of victory shall drive it. Greece has undergone many violent shocks in the Persian, Gallic, and Macedonian wars; but these would all be found unworthy of regard, if the armies now engaged in Italy should march out of that country. I view the terrible and cruel wars which involve these nations through the courage of their forces, and skill of their generals. This rage and fury cannot cease by the destruction of one party, without the ruin of their neighbours. Indeed, Macedon has less reason to dread the savage conquerors than Greece; because more prepared, and better able to defend itself; but I am sensible, those who attack each other so impetuously will not confine their victories within those bounds, and that it will be our lot to engage the conquerors." So lively a picture of imminent and threatening danger must needs alarm the most timorous, and excite them to a resolution to defend their country, and all that was dear to them. Such images give life and vigour to a discourse, and being artfully interwoven with proper arguments, influence the mind, and carry it away by an irresistible force, so that the hearer is not barely left to conclude the certainty of the thing, but moved by it, as it were, from ocular demonstration. The images therefore of the orator ought to be drawn from real things, or at least such as are probable; for if they are wholly fictitious and incredible, as many poetical images are, they may give pleasure, but will not convince the mind, nor sway the passions.

2. *Enumeration* has some affinity with the former 117
figure; by which, if the several parts have each something grand in them, the whole, when brought together, and disposed in a just order, very much contributes to the sublimity. We shall produce an example of this from an English writer, containing a description of our globe, upon a survey of it after the general conflagration, which he represents in this strong light: "Such is the vanity and transient glory of this habitable world! By the force of one element breaking loose upon the rest, all the varieties of nature, all the works of art, all the labours of man, are reduced to nothing; all that we admired and loved before, as great and magnificent, is obliterated and vanished, and another form and face of things, plain, simple, and everywhere the same, overspreads the whole earth. Where are now the great empires of the world, and their great imperial cities? their pillars, trophies, and monuments of glory? Show me where they stood, read the inscription, tell me the victor's name. What remains, what impressions, what difference or distinction, do you see in this mass of fire? Rome itself, eternal Rome, the great city, the empress of the world, whose domination or superstition, ancient or modern, make a great part of the history of the earth, what is become of her now? She laid her foundations deep, and her palaces were strong and sumptuous; *she glorified herself, and lived deliciously, and said in her heart I sit a queen, and shall see no sorrow:* but her hour is come, she is wiped away from the face of the earth, and buried in everlasting oblivion. But it is not cities only, and the works of men's hands; the everlasting hills, the mountains and rocks of the earth, are melted as wax before the sun, *and their place is nowhere found.* Here stood the Alps, the load of the earth, that covered many countries, and reached their arms from the ocean to the Black sea. This huge mass of stone is softened and dissolved, as a tender cloud into rain. Here stood the African mountains, and Atlas with his top above the clouds. There was frozen Caucasus, and Taurus, and Imaus, and the mountains of Asia; and yonder, towards the north, stood the Riphean hills, clothed in ice and snow; all these are vanished, dropped away as the snow upon their

Elocution. their heads *." These particulars considered separately are all truly great and noble, and every way suited to the nature of the subject; but as they are here disposed, and rise in order, they both enlarge the idea, and heighten the image of that grand catastrophe.

* Burnet's Theory.

118 3. *Similitude:* which serves very much for beauty and ornament; and, when taken from great and sublime objects, adds a grandeur and magnificence to the things illustrated by it. We need go no farther for an example of this, than to the great critic so often mentioned already, who has treated upon the sublime in a style every way equal to the subject. He, then, comparing those two great works of Homer, his Iliad and Odyssey, thus describes them: "Homer composed his Iliad when his mind was in its full strength and vigour: the whole body of the poem is dramatic, and full of action: whereas the best part of the Odyssey is taken up in narrations, which seem to be the genius of old age. So that one may compare him in this latter work to the setting sun, which still appears with the same magnificence, but has no longer the same heat and force." And soon after, speaking of the Odyssey, he says, "That piece may be called, the reflux of his genius, which like the ocean ebbs, and deserts its shores." What nobler idea could possibly have been given of that great poet, than by those two similitudes of the sun and the ocean? And elsewhere, comparing those two great orators Demosthenes and Cicero, he shows the like sublimity of thought. "Demosthenes (says he) is sublime, in that he is close and concise; Cicero, in that he is diffuse and extensive. The former, by reason of the violence, rapidity, strength, and fury, with which he rages and bears all before him, may be compared to a tempest, and thunder; but the latter, like a great conflagration, devours and consumes all he meets, with a fire that is never extinguished, but wherever it advances continually gathers new strength."

119 4. *Antithesis,* or a sentence consisting of opposite parts, has often the same effect; as in the following instance of Cicero, where his view is to represent Pompey as a most consummate general. "Who (says he) ever was, or need be more knowing than this man? who from his childhood, and instruction at school, went into the army of his father, and learned the military art, in a very great war against the fiercest enemics: who, while yet a boy, became a soldier under the greatest general; and when but a youth was himself commander of a very great army: who has oftener engaged with the enemy in battle, than any other person with his adversary in private contests: has waged more wars than others have read, and conquered more provinces than others have wished to govern: whose youth has been spent in acquiring the art of war, not by the precepts of others, but his own commands; not by defeats, but victories; not by campaigns but triumphs."

120 5. *Apostrophe.* Among the articles charged against Demosthenes by his great adversary and rival Æschines, one was, that he had advised the Athenians to engage in a war against King Philip, wherein they had received a very great defeat. When Demosthenes comes to answer that part of the charge, he does not say, as he might, "You have not been misled, my fellow-citizens, in exposing your lives for the liberties and safety of Greece; you are not without the most illustrious examples of such conduct; for who can say these great men were misled, who fought for the same cause in the plains of Marathon?" But instead of expressing himself thus, he gives the matter quite a different turn; and in a sort of rapture, appealing to those brave defenders of their country, says, "No, my fellow-citizens, you have not done wrong, you have not; I protest by the ghosts of those great men who fought for the same cause in the plains of Marathon." By this appeal to those ancient worthies whose memories were in the highest esteem at Athens, that it was the cause, and not the success, which rendered their actions so glorious, he artfully corroborates his assertion in a way which he knew must have the greatest weight with his audience.

As the proper subjects of this character are either divine things, or such as are in the highest esteem and regard among mankind, which often require laudatory discourses, or panegyric; these naturally admit of all the ornaments and assistance of eloquence. Which, however, must be used with discretion; for when the mind is wrapt up in thought, and stretched to the utmost of its powers in the pursuit of some noble and sublime idea, it cannot attend to all the lesser fineries and niceties of language; but from its own vigour, and lively conception of things, will be led to express them in terms the most emphatical, and best suited to their nature. In such cases, therefore, the sublimity must appear rather from the elevation of the thought, attended with a simplicity of expression, than from the ornaments and dress of the language. These things seem more natural when the mind is relaxed, and employed upon lower objects. Though, upon the whole, grandeur and majesty of expression is the proper mark of this character with relation to the language, as beauty and splendour is of the middle style.

Chap. VIII. *Of the Style of an Orator.*

121 The *low*, *middle*, and *sublime* style requisite for an orator.

The style of an orator comprehends all the characters already explained, of *low*, *middle*, and *sublime*, as they are applied by him in the different parts of his province. For that the language must be suited to the nature of the subject, we have had occasion often to observe already; and the different view of the speaker or writer necessarily occasions a variety in the manner of expression. Now an orator has three things in his view; to prove what he asserts, to represent it in an agreeable light, and to move the passions. These are all necessary, we do not mean in the order wherein we have now mentioned them, but that the discourse may upon the whole have its desired effect upon the audience. For unless the mind be convinced of the truth of what is offered by solid and cogent arguments, neither will the most eloquent discourse afford a lasting pleasure, nor the most pathetic long influence the affections. Though, on the other hand, the hearers expect to be entertained at the same time they are informed; and, therefore, unless the language be agreeable to their taste, they will soon call off their attention, and think but meanly of the speaker. And unless both these are warmed and animated by a becoming pathos, the speaker may very probably miss of his end in bringing his audience over

Elocution. over to his sentiments. For bare conviction is not sufficient with many persons to excite them to action. They will acquiesce in the truth of a thing which they cannot contradict, or will not give themselves the trouble to examine; and at the same time remain unconcerned to prosecute it. And the pleasure of a florid discourse will of itself soon vanish, like the harmony of music, or the charms of a fine poem. And therefore to captivate his audience, secure them in his interest, and push them upon action, it is necessary for the orator to engage their affections: these are, as it were, the springs of the soul, which, managed by a skilful hand, move and direct it at pleasure. Now each of these parts of an orator's province requires a different style. The *low style* is most proper for proof and information; because he has no other view here but to represent things to the mind in the plainest light, as they really are in themselves, without colouring or ornament. The *middle style* is most suited for pleasure and entertainment, because it consists of smooth and well-turned periods, harmonious numbers, with florid and bright figures. But the *sublime* is necessary in order to sway and influence the passions. Here the orator calls in all the assistance both of nature and art; the most raised and lofty thoughts, clothed with the brightest and strongest colouring, enter into this character.

But as an orator has frequently each of these views in the same discourse, we shall first give a summary description of the several characters of style, which we have formerly discoursed on more at large; that, by placing them together in one view, the difference between them may be more plain and obvious: and then we shall proceed to show to what particular parts of a discourse each of them is more especially to be applied.

I. First, then, as shorter periods are proper in the *low style*, so less care is necessary in their turn and cadency. If a sentence now and then drop unexpectedly and disappoint the ear, or has something rough and harsh in its composition, it is no blemish in this character. For as it is suited to the manner of common discourse, an appearance of regard to the subject rather than the form of expression, is more becoming than any beauties of art. But the words should be well chosen and proper, suited to the ideas they are designed to convey; the expressions plain and clear, and the artificial ornaments few and modest. By *artificial ornaments*, are here meant *tropes* and *figures*; and they are called *artificial*, because they vary from the natural dress of language, either in the words or manner of expression: though they are often used by those who are wholly unacquainted with the rules of art; and particularly metaphors, which persons who have the least command of language frequently run into through mere necessity, for want of a sufficient stock of proper words to convey their ideas. The low style therefore admits of these: but care should be taken to choose such as have been rendered familiar by use, or at least where the similitude is very plain and evident. Bold or lofty metaphors, or where the allusion is dark and remote, ought to be avoided. Nor is the moderate use of the other tropes wholly disagreeable to this style. And the same thing is to be said with respect to verbal figures, or such as consist in the particular disposition of the sentence, so that if the form of it be changed, the figure is lost. Of these, such as come nearest to the natural way of expression are most proper for this style; and therefore those which consist in a jingle of words, arising from the same or like sound, are to be avoided, as carrying in them too much the appearance of art. Those likewise which consist in a repetition of the same word have often too great a force and vehemence for this mild and gentle character. And as to figures of sentences, which do not depend on the construction of words, but lie in the sense, many of them are too gay and sprightly, and others too rapid and impetuous, for the simplicity of the low style; so that only the more moderate and sedate ones are to be allowed a place here. It is therefore no wonder if persons are often mistaken in their notions of this character: the beauty of which consisting in a certain plainness and simplicity, without any thing in it but what seems natural and common, every one is apt to imagine he can readily be master of it, till by experience he finds the contrary. For the case is much the same here, as in persons of fashion and good breeding, whose behaviour and address is attended with that agreeable freedom and seeming negligence, which in appearance is very easy to express, but in reality is scarce imitable by others.

As the *middle style* is more adapted for pleasure and delight, it admits of all those beauties and ornaments which soothe and entertain the mind. It has more force and energy than the low style, but less than the sublime. Smooth and harmonious numbers, well turned periods, of a just length, delightful cadency, and accurate disposition of the words, are suited to this style. The most beautiful and shining tropes, which strike the fancy, and all those verbal figures which, by a repetition, similitude, or proportion of sounds, please and gratify the ear, help to form this character. The like is to be said as to figures of sentences: The most florid and beautiful, such as enumeration, description, similitude, and the like, are here the most proper.

But it is the *sublime style* which perfects the orator. This requires the most forcible and emphatical words, the boldest metaphors and strongest figures. In verbal figures, repetitions, synonyms, gradations, contraries, with others of a like force and energy, are chiefly employed here. But figures of sentences are the most considerable, and principally contribute to make up this character. Among these are similies taken from lofty subjects, prosopopœia, apostrophe, exclamation, epiphonema, aposiopesis, and others of a like nature. But due care must likewise be taken of the form, construction, and harmony of the periods; which seem best disposed, when long and short ones are intermixed. For though round and swelling periods carry in them something grand and majestic, yet many times they move too slow to strike the passions; whereas short ones are more acute and pungent, and by returning quick, awaken the mind, and raise the passions. But to render it complete, it must be supported with strong reason, grandeur of thought, and sentiments every way equal to the expression; without which it will be very liable to swell into bombast, and end barely in amusement.

II. Having given a short sketch of this part of the orator's furniture, we shall now go on to show where, and in what manner, he is to make use of it. This will

Elocution. will best appear by considering his principal view in each part of his discourse. Now the parts of a just oration (as we have formerly shown) are six; *Introduction*, *Narration*, *Proposition*, *Confirmation*, *Confutation*, and *Conclusion*. Not that all these are necessary in every discourse, but it is proper they should all be mentioned, that we may consider what style is fittest for them when they are necessary.

122 In the *Introduction*, the orator has three things before him; to gain the esteem of his hearers, to secure their attention, and to give them some general notion of his subject. To set out modestly is undoubtedly the most likely way to recommend himself. For to attempt to inflame an audience, before they are prepared for it, or see the reason of much warmth, is highly improper. A prudent speaker will, like Demosthenes, begin with temper, and rise gradually, till he has insensibly warmed his hearers, and in some degree engaged their affections in his favour. So that this part scarcely rises above the middle style. And if it carry in it an air of pleasantry and good-humour, it is generally the more apt to engage the attention.

123 The introduction is usually followed by the *narration*, or a recital of such things as either preceded, accompanied, or followed upon the subject under consideration. Now, as the qualities that recommend a narration are clearness, brevity, and probability; these sufficiently point out the style. Perspicuity arises from the choice of proper words, and such tropes as have been rendered most familiar by use; brevity requires moderate periods, whose parts are but little transposed; and a plain and simple dress, without ornament or colouring, is best suited to represent things probable: all which are the properties of the low style. And therefore Cicero says, *narrations come pretty near to our ordinary discourse*. Indeed, sometimes it is necessary not only to relate the facts themselves, but likewise to describe the manner in which they were performed. And then a further degree of art may be requisite to represent them with all their circumstances, and paint them to the mind in their proper colours.

124 The next part in order is the *proposition*, or subject of the discourse in which there can be no room for ornament. But as it is the basis and foundation of the orator's whole design, it ought to be laid down in the plainest and clearest terms, so as to leave no room for doubt or uncertainty what it is which he intends to discourse upon.

125 The next thing is *confirmation*, wherein the orator endeavours to maintain and defend his own cause, and to convince his hearers of the truth of it by reason and argument. Now the low style is certainly fittest for cool reasoning and debate. But the orator's method of reasoning often very much differs from that of the philosopher. The latter contents himself with the most plain and familiar manner of representing the truth, and thinks it sufficient if what he says be clearly understood. But the former, at the same time that he convinces the judgment, endeavours likewise to affect the passions, and that in a great variety of ways. So that in this part of the discourse the style is very different, according to the nature and circumstances of the case. Sometimes, while he is dwelling upon the proof of a thing, he talks coolly, and reasons with the sedateness of a philosopher; and where any part of his argument appears doubtful or obscure, he endeavours with the same even temper to explain and clear it up. But frequently he intermixes with his proofs all the arts of persuasion, and embellishes his reasons with the greatest ornaments and beauties of eloquence.

Confirmation is usually followed by *confutation*, in which the orator endeavours to enervate and overthrow all that has been advanced in favour of the opposite side of the question. But as the style is much the same here as in the former part, what has been said upon that may be sufficient for this likewise. 126

The last part above mentioned is the *conclusion*. This consists of two branches, *recapitulation*, and *address*. Recapitulation is a short recital of the several arguments, at the least the chief of them, which were before advanced in support of the cause; that, being brought together into a narrow compass, they may appear in a stronger light. Wherefore the language here ought rather to be forcible and strong than florid, because brevity and conciseness is a necessary quality. The other branch of the conclusion consists in an address to the passions, and is wholly persuasive; for which the speaker is now entirely at leisure. Indeed, this is often done occasionally in other parts of the discourse, particularly in the introduction and confirmation: But, as in the former of these, his view is principally to secure the good opinion of the hearers, and excite their attention; and in the latter to defend his own side of the question by reason and argument; when these two points are gained, he has nothing left but to prevail with them to fall in with his design, and declare for him. And the best way to attain this is, by engaging their passions in his interest. Hence, then, to use Quintilian's words, "All the springs of eloquence are to be opened. Now we are past the rocks and shallows, all the sails may be hoisted. And as the greatest part of the conclusion consists in illustration, the most pompous language and strongest figures have place here." 127

All the variety above mentioned, however, is not always necessary. Regard must be had to the nature of the subject, the time, place, persons, and other circumstances; by all which the style is to be regulated. To discourse in a lofty and grand way upon a common topic, or in a low and flat manner upon a sublime argument, are both equally injudicious. Cicero refers us to some discourses of his own, as instances of each kind. His oration for Cæcina, he says, is written in the low style, that for the Manilian law in the middle style, and that for Rabirius in the sublime; and his Actions against Verres, with some others, are patterns of the variety here mentioned. And he gives us a very comprehensive description of a perfect orator in very few words, when he says, "He is one who can speak upon a low subject acutely, upon a lofty subject with sublimity, and upon a moderate subject temperately." By which he means no more, than one who is master of the three characters here described, and knows when and how to use them. But although he mentions several among the Greeks, and some few among the Romans, who excelled in one or other of these different kinds; yet one who excelled in them all, he supposes never to have existed, except in the imagination. The reason perhaps

Pronunciation.

perhaps may be, because each of them seems to require a very different genius, so that it is scarce possible for the same person to succeed in them all. Since therefore it is so rare and difficult a matter to gain the command of each in any good degree, it is better perhaps for every one to pursue that which nature seems most inclined to, and to excel in it, than to strive against their genius. For every kind has its perfections; and it is more commendable to be master of one thing, than to do several but indifferently.

PART IV. OF PRONUNCIATION.

CHAP. I. *Of Pronunciation in general.*

128 Pronunciation a conformity of the voice and gesture to the subject.

PRONUNCIATION is also called *Action* by some of the ancients. Though, if we attend to the proper signification of each of these words, the former respects the voice, and the latter the gestures and motions of the body. But if we consider them as synonymous terms, in this large sense pronunciation or action may be said to be *a suitable conformity of the voice, and the several motions of the body, in speaking, to the subject matter of the discourse.*

The best judges among the ancients have represented this as the principal part of an orator's province, from whence he is chiefly to expect success in the art of persuasion. When Cicero, in the person of Crassus, has largely and elegantly discoursed upon all the other parts of oratory, coming at last to speak of this, he says: "All the former have their effect as they are pronounced. It is the action alone that governs in speaking; without which the best orator is of no value, and is often defeated by one in other respects much his inferior." And he lets us know, that Demosthenes was of the same opinion, who, when he was asked what was the principal thing in oratory, replied, action; and being asked again a second and a third time, what was next considerable, he still made the same answer. By which he seemed to intimate, that he thought the whole art did in a manner consist in it. And indeed, if he had not judged this highly necessary for an orator, he would scarce have taken so much pains in correcting those natural defects, under which he laboured at first, in order to acquire it. For he had both a weak voice, and likewise an impediment in his speech, so that he could not pronounce distinctly some particular letters. The former of which defects he conquered, partly by speaking as loud as he could upon the shore, when the sea roared and was boisterous; and partly by pronouncing long periods as he walked up hill; both of which methods contributed to the strengthening of his voice. And he found means to render his pronunciation more clear and articulate, by the help of some little stones put under his tongue. Nor was he less careful in endeavouring to gain the habit of a becoming and decent gesture; for which purpose he used to pronounce his discourses alone before a large glass. And because he had got an ill custom of drawing up his shoulders when he spoke; to amend that, he used to place them under a sword, which hung over him with the point downward. Such pains did this prince of the Grecian orators take to remove those difficulties, which would have been sufficient to discourage an inferior and less aspiring genius. And to how great a perfection he arrived in his action, under all these disadvantages, by his indefatigable diligence and application, is evident from the confession of his great adversary and rival in oratory, Æschines. Who, when he could not bear the disgrace of being worsted by Demosthenes in the cause of Ctesiphon, retired to Rhodes. And being desired by the inhabitants to recite to them his own oration upon that occasion, which accordingly he did; the next day they requested of him to let them hear that of Demosthenes; which having pronounced in a most graceful manner, to the admiration of all who were present, "How much more (says he) would you have wondered if you had heard him speak it himself!" By which he plainly gave Demosthenes the preference in that respect. We might add to these authorities the judgment of Quintilian, who says, that "it is not of so much moment what our compositions are, as how they are pronounced; since it is the manner of the delivery by which the audience is moved." And therefore he ventures to assert, that "an indifferent discourse, assisted by a lively and graceful action, will have greater efficacy than the finest harangue which wants that advantage."

The truth of this sentiment of the ancients concerning the power and efficacy of pronunciation, might be proved from many instances; but one or two may here suffice. Hortensius, a contemporary with Cicero, and while living next to him in reputation as an orator, was highly applauded for his action. But his orations after his death, as Quintilian tells us (for we have none of them now remaining), did not appear answerable to his character; from whence he justly concludes, there must have been something pleasing when he spoke by which he gained his character, which was lost in reading them. But perhaps there is scarce a more considerable instance of this than in Cicero himself. After the death of Pompey, when Cæsar got the government into his own hands, many of his acquaintance interceded with him in behalf of their relations and friends, who had been of the contrary party in the late wars. Among others, Cicero solicited for his friend Ligarius; which Tubero understanding, who owed Ligarius a grudge, he opposed it, and undertook to represent him to Cæsar as unworthy of his mercy. Cæsar himself was prejudiced against Ligarius; and therefore, when the cause was to come before him, he said, "We may venture to hear Cicero display his eloquence; for I know the person he pleads for to be an ill man, and my enemy." But, however, in the course of his oration, Cicero so worked upon his passions, that by the frequent alteration of his countenance, the emotions of his mind were very conspicuous. And when he came to touch upon the battle of Pharsalia, which had given Cæsar the empire of the world, he represented it in that moving and lively a manner, that Cæsar could no longer contain himself, but was thrown into such a fit of shivering, that he dropped the papers which

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which he held in his hand. This was the more remarkable, because Cæsar was himself one of the greatest orators of that age, knew all the arts of address, and avenues to the passions, and consequently was better prepared to guard against them. But neither his skill, nor resolution of mind, was of sufficient force against the power of oratory; but the conqueror of the world became a conquest to the charms of Cicero's eloquence; so that, contrary to his intention, he gave into his plea, and pardoned Ligarius. Now that oration is still extant, and appears exceedingly well calculated to touch the soft and tender passions and springs of the soul; but we believe it can scarce be discernible to any in reading it, how it should have had so surprising an effect; which must therefore have been chiefly owing to the wonderful address and conduct of the speaker.

The more natural the pronunciation is, it will of consequence be the more moving, since the perfection of art consists in its nearest resemblance to nature. And therefore it is not without good reason, that the ancients make it one qualification of an orator, that he be a good man; because a person of this character will make the cause he espouses his own, and the more sensibly he is touched with it himself, his action will be the more natural, and by that means the more easily affect others in the same manner. Cicero, speaking upon this subject, says, "It is certain that truth (by which he means nature) in every thing excels imitation; but if that was sufficient of itself in action, we should have no occasion for art." In his opinion therefore (and who was ever a better judge), art, in this case as well as in many others, if well managed, will assist and improve nature. But that is not all; for sometimes we find the force of it so great and powerful, that, where it is only counterfeit, it will for the time work the same effect as if it was founded in truth. This is well known to those who have been conversant with the representations of the theatre. In tragedies, though we are sensible that every thing we see and hear is feigned and counterfeit, yet such is the power of action, that we are oftentimes affected by it in the same manner as if they were all realities. Anger and resentment at the appearance of cruelty, concern and solicitude for distressed virtue, rise in our breasts; and tears are extorted from us for oppressed innocence, though at the same time, perhaps, we are ready to laugh at ourselves for being this decoyed. If art then has so great an influence upon us, when supported only by fancy and imagination, how powerful must be the effect of a just and lively representation of what we knew to be true and real?

How agreeable it is both to nature and reason, that a warmth of expression and vehemency of motion should rise in proportion to the importance of the subject and concern of the speaker, will further appear, by looking back a little into the more early and simple ages of the world. For the higher we go, the more we shall find of both. We shall give the observation of a very great man upon this head, in his own words. "The Romans (says he) had a very great talent this way, and the Greeks a greater. The eastern nations excelled in it, and particularly the Hebrews. Nothing can equal the strength and vivacity of the figures they employed in their discourse: and the very actions they used to express their sentiments, such as putting ashes on their heads, and tearing their garments, and covering themselves with sackcloth under any deep distress and sorrow of mind. I do not speak of what the prophets did to give a more lively representation of the things they foretold, because such figurative actions were the effect of divine inspiration. But even in other cases we find those people understood much better than we do how to express their grief, and fear, and other passions. And hence, no doubt, arose those surprising effects of eloquence, which we never experience now." Thus far this excellent writer. And what he says here with respect to the actions of the eastern nations, was in a good measure customary among the Greeks and Romans; if not entirely of the same kind, yet perhaps as vehement and expressive. They did not think language of itself sufficient to express the height of their passions, unless enforced by uncommon motions and gestures. Thus, when Achilles had driven the Trojans into their city with the greatest precipitation and terror, and only Hector ventured to tarry without the gates to engage him; Homer represents both King Priam and his queen under the highest consternation for the danger of their son. And therefore, in order to prevail with him to come into the city, and not fight with Achilles, they not only intreat him from the walls in the most tender and moving language imaginable; but he tears off his grey locks with his hands; and she, in a flood of tears, exposes her breasts, and adjures him by these paps which suckled him, to comply with their request. The poet knew very well, that no words of themselves could represent those agonies of mind he endeavoured to convey, unless heightened by the idea of such actions as were expressive of the deepest sorrow. And indeed this was anciently esteemed so requisite in an orator, that in matters of importance he was scarce thought to be in earnest who wanted it. In one of Cicero's orations, he does not stick to argue in that manner with his adversary. "Would you talk thus (says he) if you was serious? Would you, who are wont to display your eloquence so warmly in the danger of others, act so coldly in your own? Where is that concern, that ardour, which used to extort pity even from children? Here is no emotion either of mind or body: neither the forehead struck, nor the thigh, nor so much as a stamp of the foot. Therefore, you have been so far from inflaming our minds, that you have scarce kept us awake."

Dial. of Eloquence, p. 92.

As action therefore was judged so necessarily a qualification in an orator among the ancients, so they made use of several methods and expedients for the better attaining it. The principal of which we shall briefly mention.

Decency of pronunciation is a habit. And as all habits are gained by time, so the sooner they are learned, they are generally acquired with greater ease. For while persons are young, they are not only more flexible and capable of any particular bent, but they are likewise free from the trouble of encountering and subduing contrary habits, which doubles the labour, and increases the difficulty of attaining any laudable quality. Quintilian was very sensible of this in the case here before us; and therefore, in order to have persons trained up to it, he begins with them in their childhood, and descends so low as even to give directions how they should be taught to pronounce when they first learn to read. And he advises, that they should then be instructed where to suspend their voice, and make the proper pauses, Pronunciation. ses, both in distinguishing the several parts of the same sentence, and in separating one sentence from another; likewise when to raise or sink their voice, or give it a proper inflection; to be slower or faster, more vehement or sedate, as the nature of the things may require; and that the tone of their voice be always manly and grave, but at the same time mixed with an agreeable sweetness. These things may perhaps appear in themselves small; but if duly attended to, they will be found of considerable service to bring us to a just and proper pronunciation. For in every thing that is to be attained by practice, it is a great advantage to set out right at first.

The ancients likewise had persons whom they called *phonasci*, whose proper business it was to teach them how to regulate and manage their voice; and others, who instructed them in the whole art of pronunciation, both as to their voice and gestures. These latter were generally taken from the theatre, being some eminent experienced actors. So Quintilian, treating of the province of these persons, says, "The comedian ought to teach them how to relate facts, with what authority to advise, with what vehemence to express anger, and with what softness compassion." And speaking of gestures, he says, "He should admonish them to raise their countenance, not distort their lips, or stretch their mouths." With several other directions of the like kind. And we are told concerning the emperor M. Antoninus, usually called the philosopher, that *His first masters were Euphorio the grammarian, and Geminus the comedian.*

But though they made use of actors to instruct their youth in forming their speech and gestures, yet the action of an orator was much different from that of the theatre. Cicero very plainly represents this distinction in the words of Crassus, when, speaking of orators, he says, "The motions of the body ought to be suited to the expressions, not in a theatrical way, mimicking the words by particular gesticulations, but in a manner expressive of the general sense, with a sedate and manly inflection of the sides; not taken from the stage and actors, but from the exercise of arms and the palestra." And Quintilian says to the same purpose, "Every gesture and motion of the comedians is not to be imitated, nor to the same degree." They thought the action of the theatre too light and extravagant for the imitation of an orator; and, therefore, though they employed actors to inform young persons in the first rudiments, yet they were afterwards sent to the palestra, or schools designed on purpose, to teach them a decent and graceful management of their bodies. And such schools, as Quintilian informs us, were in use both among the Greeks and Romans: Just as of later ages children learn to dance, in some measure with the same intention.

Being thus far prepared, they were afterwards sent to the schools of the rhetoricians. And here, as their business was to cultivate their style, and gain the whole art of eloquence; so particularly to acquire a just and accurate pronunciation by those exercises, in which for that end they were constantly employed. And as the Greeks were most celebrated for their skill in all the polite arts, and especially oratory; the Roman gentry and nobility generally sent their sons abroad, and placed them under the tuition of some Grecian master, to instruct them in the art of speaking, and by that means to fit them for the service of their country, either in the courts of judicature or the senate. Thus Cicero was sent to Rhodes, to study under the famous Molo, and Brutus under Pammenes; Cæsar was going to the same place when taken by pirates; and Augustus afterwards studied there under Apollodorus.

Nor, after all this pains and industry, did they yet think themselves sufficiently qualified to take upon them the character of orators. But it was their constant custom to get together some of their friends and acquaintance who were proper judges of such performances, and declaim before them in private. The business of these persons was to make observations both on their language and pronunciation. And they were allowed the greatest freedom to take notice of any thing they thought amiss, either as to inaccuracy of method, impropriety of style, or indecency of their voice or actions. This gave them an opportunity to correct any such defects at first, before they became habitual. What effects might not justly be expected from such an institution! Persons trained up in this manner, with all those advantages, joined to a good natural genius, could not fail of making very complete orators. Though even after they came to appear in public, they did not lay aside the custom of declaiming. For Quintilian tells us, that *C. Carbo used to practise it daily in his tent.* And Augustus is reported to have continued it during the war of Mutina against M. Antony. Nor is it to be supposed, that so constant an attendance to this practice was only serviceable to them in their public performances; but it must necessarily affect their whole conduct, give them a freedom of speech, easiness of address and behaviour, and render them in all respects fine gentlemen as well as excellent orators. And from hence, perhaps, we may see less reason to wonder at the surprising effects of some of their discourses, when we consider what pains they took to arrive at those abilities.

Having thus far treated on pronunciation in general, we shall now proceed to consider the parts of it separately; which are *voice* and *gesture*.

Chap. II. *Of the Voice.*

Voice is one kind of sounds. Now the influence of sounds, either to raise or allay our passions, is evident from music. And certainly the harmony of a fine discourse, well and gracefully pronounced, is as capable to move us, if not in a way so violent and ecstatic, yet not less powerful, and more agreeable to our rational faculties. As the business of this chapter is to offer some considerations for the just and decent management of the voice, it may not be improper in the first place to observe in general what nature does when free and unconstrained. As persons are differently affected when they speak; so they naturally alter the tone of their voice, though they do not attend to it. It rises, sinks, and has various inflections given it, according to the present state and disposition of the mind. When the mind is calm and sedate, the voice is moderate and even; when the former is dejected with sorrow, the latter is languid; and when that is inflamed by passion, this is raised and elevated. It is the orator's business, therefore, to follow nature, and to endeavour that the tone of his voice appear natural and unaffected. And for this

119 Voice, a kind of sound which always influences the passions, either by raising or allaying them.

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this end, he must take care to suit it to the nature of the subject; but still so as to be always grave and decent. Some persons continue a discourse in such a low and drawling manner, that they can scarce be heard by their audience. Others again hurry on in so loud and boisterous a manner, as if they imagined their hearers were deaf. But all the music and harmony of speech lies in the proper temperament of the voice between these extremes. In order to set this matter in a just light, it will be necessary to consider the principal affections or properties of the voice, and how they are to be regulated by an orator. Now these may all be referred either to *quantity* or *quality*.

The *quantity* of the voice consists in its *highness* or *lowness*, *swiftness* or *slowness*, and the intermediate degrees between them.

Every person who speaks in public should endeavour, if he can, to fill the place where he speaks. But still he ought to be careful not to exceed the natural key of his voice. If he does, it will neither be soft nor agreeable, but either harsh and rough, or too shrill and squeaking. Besides, he will not be able to give every syllable its full and distinct sound; which will render what he says obscure, and difficult to be understood. He should therefore take care to keep his voice within reach, so as to have it under management, that he may raise or sink it, or give it any inflection he thinks proper: which it will not be in his power to do if he put a force upon it, and strain it beyond its natural tone.

The like caution is to be used against the contrary extreme, that the voice be not dropped, and suffered to sink too low. This will give the speaker pain in raising it again to its proper pitch, and be no less offensive to the hearers. For though the music of speech consists in the variations of the voice, yet they must be gradual to render them pleasant. Such sudden and great changes at once are rather to be esteemed chasms in speaking than variations. Besides, as they often prevent the hearers from taking in the sense of what is said, it gives them no small uneasiness that they are obliged to stretch their attention. Many persons are too apt to be guilty of this, especially at the end of a sentence, by dropping the last word; which ought, in a particular manner, to be expressed distinctly, because the meaning of the whole sentence often depends upon it.

The medium between these two is a moderate and even voice. But this is not the same in all; that which is moderate in one would be high in another Every person, therefore, must regulate it by the natural key of his own voice. A calm and sedate voice is generally best; as a moderate sound is most pleasing to the ear, if it be clear and distinct. But this equality of the voice must also be accompanied with a variety, otherwise there can be no harmony; since all harmony consists in variety. Nothing is less pleasing than a discourse pronounced throughout in one continued tone of the voice, without any change or alteration. Besides, a variation of the voice is an ease to the speaker; as the body is relieved by shifting its posture. The equality, therefore, we are here speaking of admits a variety of inflections and changes within the same pitch. And when that is altered, the gradations, whether higher or lower, should be so gentle and regular as to preserve a due proportion of the parts and harmony of the whole, which cannot be done when the voice is suddenly varied with too great a distinction. And therefore it should move from one key to another, so as rather to glide like a gentle stream, than pour down like a rapid torrent, as an ingenious writer has well expressed it. An even voice is best fitted to keep the mind to close attention. And therefore, in subjects designed only for instruction, without any address to the passions, there is little room for a variety of voice. For the voice ought to agree with the style; and as upon such subjects this should be equal, moderate, and smooth, so should the other. Every thing, as we say, is beautiful in its season; and there is a certain propriety in things which ought always to be regarded. And, therefore, an affected variety, ill-placed, is as disagreeable to a judicious audience as the want of it, where the subject requires it. We may find some persons, in pronouncing a grave and plain discourse affect as many different tones, changes, and variations of their voice, as if they were acting a comedy; which is doubtless a very great impropriety. But the orator's province is not barely to apply to the mind, but likewise to the passions; which require a great variety of the voice, high, or low, vehement or languid, according to the nature of the passions he designs to affect. So that for an orator always to use the same tone or degree of his voice, and expect to answer all his views by it, would be much the same thing as if a physician should propose to cure all distempers by one medicine. From hence it is evident, that although various inflections and tones of the voice are requisite to make it harmonious and pleasing to the ear; yet the degree of it should differ according to the nature of the subject, and design of the speaker. And, as a perfect monotony is always unpleasant, so it can never be necessary in any discourse.

The next property of the voice above mentioned was *swiftness*. That some expressions ought to be pronounced faster and swifter than others, is very manifest. Gay and sprightly ideas should not only be expressed louder, but also faster, than such as are sad and melancholy. And when we press an adversary, the voice should be brisk and quick. But to hurry on in a precipitant manner, without pausing till stopt for want of breath, is certainly a very great fault. This destroys, not only the necessary distinction between sentence and sentence, but likewise between the several words of the same sentence; nay, and often occasions us to express our words by halves, while one is thrown so fast upon another, that we are not able to give each its full and just sound. By this means all the grace of speaking is lost, and in a great measure the advantage of hearing. For when the ears of the hearers cannot keep pace with the volubility of the speaker's tongue, they will be little the better for what he says. Besides, by not commanding his voice, and easing his breath at the proper pauses and points of distinction, he is often obliged to stop in the middle of a sentence; and so divides what should be continued, and joins what should be separated; which must necessarily destroy the sense, and confound his discourse. Young persons are very liable to this, especially at first setting out. And it often arises from diffidence. They are jealous of their performances, and the success they may have in speaking, which gives them a pain till it is over; and this puts them into a hurry of mind, which incapacitates them from governing their voice, and keeping it under that due

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due regulation which perhaps they proposed to themselves before they began to speak. And the greater degree such persons have of a native and ingenuous modesty, accompanied with a laudable ambition to excel, they are commonly more exposed to this. For while, on the one hand, they are fired with an ardent desire to recommend themselves, and on the other are fearful of the event, this dubious state of mind is very apt to throw them off their guard, and run them into this excess. From which we may see the great advantage of having the voice well formed betimes; for when once it is become habitual to speak with justness and propriety, persons readily practise it without much attention or concern.

And as a precipitant and hasty pronunciation is culpable, so likewise, on the other hand, it is a fault to speak too slow. This seems to argue a heaviness in the speaker. And as he appears cool himself, he can never expect to warm his hearers, and excite their affections. When not only every word, but every syllable is drawn out to too great a length, the ideas do not come fast enough to keep up the attention without much uneasiness. For till the sense is completed, the mind is in suspense: and, if it be held long in that situation, it will of course flag and grow tired. Indeed, in some cases, it is requisite the pronunciation should be slower than in others; as in representing things great and difficult; or in expressing some particular passions, as admiration or grief. But the extreme we are now speaking of, is a slowness equally continuing through a whole discourse, which must necessarily render it flat and lifeless.

Now, to avoid either of the two extremes last mentioned, the voice ought to be sedate and distinct. And in order to render it distinct, it is necessary, not only that each word and syllable should have its just and full sound, both as to time and accent; but likewise that every sentence, and part of a sentence, should be separated by its proper pause and interval. This is more easy to be done in reading, from the assistance of the points; but it is no less to be attended to in speaking, if we would pronounce in a distinct and graceful manner. For every one should speak in the same manner as he ought to read, if he could arrive at that exactness. Now the common rule given in pausing is, that we stop our voice at a comma till we can tell one, at a semicolon two, at a colon three, and at a full period four. And as these points are either accommodated to the several parts of the same sentence, as the first three; or different sentences, as the last; this occasions the different length of the pause, by which either the dependence of what precedes upon that which follows, or its distinction from it, is represented. And, therefore, in the first three stops, the voice is rather to be suspended in different degrees or measures of time than entirely dropt, to shew that the sense is not yet completed. But between sentence and sentence we respire, and begin anew. So that in long periods, the voice should be favoured by beginning low and sedately, that it may hold to the end without respiration; or if it will not, the breath ought to be recovered without sinking the voice. For if once the voice drop for want of breath before the period be finished, not only the beauty, but likewise the sense of it, will be lost. Quintilian lays a great stress upon a due attention to these pauses; and says, "Though it may appear not so considerable in itself, yet all the other virtues of a good pronunciation are deficient without it."

Hitherto we have considered such properties of the voice as respect *quantity*, we come now to speak of its *qualities*. And the chief of these are *strength* or *weakness*, *clearness* or *obscureness*, *fulness* or *smallness*, *smoothness* or *roughness*. Now, one half of these is what every one would willingly choose, as he would wish to be free from the others. But it is not in our power to give ourselves what qualities of the voice we please; but only to make the best use we can of what nature has bestowed upon us. However, several defects of the voice are capable of being helped by care and proper means; as, on the other hand, the best voice may be greatly hurt by ill management and indiscretion. Temperance is a great preservative of the voice, and all excess is highly prejudicial to it. The voice must necessarily suffer, if the organs of speech have not their proper tone. And in order to their having this, they must be kept in due temperature; that is, they must neither be too moist nor too dry. If they abound with fluids, these will obstruct the clearness of the voice, and render it obscure and confused; and if they are parched with drought, the voice will be harsh and rough. Now all excesses, as well as some bodily indispositions, are apt to affect the organs one or other of these ways.

A strong voice is very serviceable to an orator, because if it want some other advantages, he is, however, capable to make himself heard. And if at any time he is forced to strain it, he is in less danger of its failing him before he has finished his discourse. But he who has a weak voice, should be very careful not to strain it, especially at first. He ought to begin low, and rise gradually to such a pitch as the key of his voice will well carry him, without being obliged to sink again afterwards. Frequent inflections of the voice will likewise be some assistance to him. But especially he should take care to speak deliberately, and ease his voice, by allowing due time for respiration at all the proper pauses. It is an extreme much less inconvenient for such a person rather to speak too slow, than too fast. But this defect of a weak voice is sometimes capable of being helped by the use of proper methods; as is evident from the instance of Demosthenes, before mentioned.

A voice is said to be *clear*, when the organs of speech are suited to give every single letter, and all the combinations of them in syllables and words, their proper and distinct sound. Such a voice is very pleasing and agreeable to the hearers; and no less an happiness to the speaker, as it saves him a great expence of spirits. For a moderate voice, if clear, will be as distinctly heard, as one much louder, if thick and obscure. Which is a great advantage to the speaker, because he can better keep his voice under command, and modulate it at pleasure, as the several parts and circumstances of his discourse may require. On the contrary, an obscure and confused voice is not always occasioned from a deficiency in the organ; but many times is the effect of custom and a bad habit. Some persons, either from want of due care in their education at first, or from inadvertency and negligence afterwards, run into a very irregular and confused manner of expressing their words; either by misplacing the accent, confounding the sound of the letters,

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letters, or huddling the syllables one upon another, so as to render what they say often unintelligible. Indeed, sometimes this arises from a natural defect, as in the case of Demosthenes; who found a method to rectify that, as well as the weakness of his voice. But in faults of this kind, which proceed from habit, doubtless the most likely way to mend them is to speak deliberately.

A full voice is not the same as a strong or a loud voice. It fills the ear but it is often not pleasant. And therefore to render it so, as well as audible, it should be frequently varied. However, this seems better suited to the character of an orator, than a small and shrill voice; because it has something in it more grave and manly. And those who have the misfortune of a very small voice, should be cautious of raising it to too high a pitch, especially at once; because the sudden compressure of the organ is apt to occasion a squeaking and very disagreeable sound.

A soft and smooth voice is of all the most musical, especially if it be flexible. And, on the contrary, nothing is less harmonious than a voice that is harsh and rough. For the one grates as disagreeably upon the ear, as the other gives it pleasure and delight.

From the consideration of these several properties of the voice, we may conclude that to be the best, and fittest for an orator, which is moderate, distinct, firm, clear, and smooth, and withal easily flexible to the several degrees and variations of sound which every part of the discourse may require.

Chap. III. *Of Gesture.*

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Gesture is the conformity of the motions of the countenance, &c. to the nature of the discourse.

By this is meant, a suitable conformity of the motions of the countenance, and several parts of the body, in speaking, to the subject-matter of the discourse. The word *gesture* is here used in a larger sense than is ordinarily done in common language. For we rarely make use of that word to denote the motions of the countenance, or any parts of it; but as these make a considerable part of our present subject, they must here be comprehended under this term.

It is not agreed among the learned, whether voice or gesture has the greater influence upon us. But as the latter affects us by the eye, as the former does by the ear, gesture in the nature of it seems to have this advantage, that it conveys the impression more speedily to the mind; for the sight is the quickest of all our senses. Nor is its influence less upon our passions; nay, in some instances it appears to act more powerfully. A cast of the eye shall express desire in as moving a manner as the softest language; and a different motion of it, resentment. To wring the hands, tear the hair, or strike the breast, are all strong indications of sorrow. And he who claps his hand to his sword, throws us into a greater panic than one who only threatens to kill us. Nor is it in some respects less various and extensive than language. Cicero tells us, he often diverted himself by trying this with Roscius the comedian; who could express a sentence as many ways by his gestures, as he himself by words. And some dramas, called *pantomimes*, have been carried on wholly by mutes, who have performed every part by gestures only, without words, in a way very intelligent, as well as entertaining to the spectators. Well, therefore, might Cicero call *action* (or gesture) *the language of the body*, since it is capable in so lively a manner to convey both our ideas and passions. But with respect to oratory, gesture may very properly be called the *second part of pronunciation*; in which, as the voice should be suited to the impressions it receives from the mind, so the several motions of the body ought to be accommodated to the various tones and inflections of the voice. When the voice is even and moderate, little gesture is required; and nothing is more unnatural than violent motion, in discoursing upon ordinary and familiar subjects. The motions of the body should rise therefore in proportion to the vehemence and energy of the expression, as the natural and genuine effect of it.

But as gesture is very different and various as to the manner of it, which depends upon the decent conduct of several parts of the body; it will not be amiss to consider more particularly the proper management of each of those parts. Now all gesture is either natural, or from imitation. By natural gesture we mean such actions and motions of the body, as naturally accompany our words, as these do the impressions of our minds. And these either respect the whole body, or some particular part of it. But before we enter upon this, give us leave just to observe, that it has been customary in all ages and countries, in making a set discourse before an assembly, to do it standing. Thus we read, that *Abraham stood up, and spake unto the children of Heth.* And it seems as if he sat down when he had ended his speech; because, immediately after the account of their answer, it is said again, that *Abraham stood up and bowed himself to the people of the land, the children of Heth.* In like manner Homer represents the Grecian princes, as standing up, when they made a speech, either to the army, or in their councils. So when Achilles has assembled the army, to inquire into the reason of the great plague which at that time raged among them, he rises up before he begins to speak, and sits down again when he has done. After him the prophet Calchas rises, and charges it upon Agamemnon; who rising up in a passion, does not refuse to comply with what Calchas proposed, but expresses his resentment at him for saying it. And upon another occasion both Agamemnon and Nestor do the same in council. And Cicero acquaints us, that when Lentulus had been charged in the senate as an associate with Catiline, he stood up to make his defence. Nor does the advantage of being better heard, seem to have been the only reason for so general an agreement in this posture; but it appears likewise to have been chosen, as the most decent and respectful. Sitting carries in it an air of authority, and is therefore a posture scarce used upon such occasions, unless perhaps where that is designed to be expressed by it. Wherefore it was a thing very much resented, that when Cæsar after he had got the power into his hands, once addressed the senate, either refused to rise, as some say, or as others, one of his friends held him down by his gown.

But though standing appears to be the most proper posture for speaking in public, yet it is very unbecoming for the body to be entirely without any motion like a statue. It should not long continue in the same position, but be constantly changing, though the motion be very moderate. There ought to be no appearance of stiffness, but a certain ease and pliableness, naturally suiting itself to every expression; by which

which means, when a greater degree of motion is necessary, it will appear less sudden and vehement: For as the raising, sinking, and various inflections of the voice must be gradual; so likewise should the motion of the body. It is only on some particular occasions that an hasty vehemence and impetuosity is proper in either case.

As to the several parts of the body, the head is the most considerable. To lift it up too high has the air of arrogance and pride; to stretch it out too far, or throw it back, looks clownish and unmannerly; to hang it downwards on the breast, shows an unmanly bashfulness and want of spirit: and to suffer it to lean on either shoulder, argues both sloth and indolence. Wherefore in calm and sedate discourse it ought to keep its natural state, an upright posture. However, it should not be long without motion, nor yet always moving; but gently turn sometimes on one side, and sometimes on the other, as occasion requires, that the voice may be heard by all who are present; and then return again to its natural position. It should always accompany the other actions of the body, and turn on the same side with them; except when aversion to any thing is expressed, which is done by stretching out the right hand, and turning the head to the left. The ancients erected a statue of Venus in this posture, who was called by the Greeks *αποςροφια*, and by the Latins *Verticordia*, and in English may be termed the *forbidding Venus*. But nothing is more indecent than violent motions and agitations of the head. And therefore when a witty writer, who is well known among us, would convey the most ridiculous idea of a pretender to knowledge, he expresses it thus:

> For having three times shook his head
> To stir his wit up, thus he said. HUDIBRAS.

But it is the countenance that chiefly represents both the passions and disposition of the mind. By this we express love, hatred, joy, sorrow, modesty, and confidence: by this we supplicate, threaten, soothe, invite, forbid, consent, or refuse; and all this without speaking. Nay, from hence we form a judgment not only of a person's present temper, but of his capacity and natural disposition. And therefore it is common to say, *such an one has a promising countenance*, or *that he promises little by his countenance*. It is true, this is no certain rule of judging; nor is it in the power of any one to alter the natural make of his countenance: however, it may put us upon endeavouring to gain the most pleasing aspect we can; since it is so natural for mankind to draw such conclusions from it: and some persons are so unhappy, as to render their countenance more disagreeable, than otherwise it would be, by ill habits.

But the several parts of the face bear their part, and contribute to the proper and decent motion of the whole. In a calm and sedate discourse, all the features retain their natural state and situation. In sorrow, the forehead and eyebrows lower, and the cheeks hang down. But in expressions of joy and cheerfulness, the forehead and eyebrows are expanded, the cheeks contracted, and the corners of the mouth drawn upwards. Anger and resentment contract the forehead, draw the brows together, and thrust out the lips. And terror elevates both the brows and forehead. As these are the natural signs of such passions, the orator should endeavour to conform to them.

But as the eyes are most active and significant, it is the advice of Cicero that the greatest care should be taken in their management. And he gives this reason for it, "Because other parts of the countenance have but few motions; whereas all the passions of the soul are expressed in the eyes, by so many different actions, which cannot possibly be represented by any gestures of the body, if the eyes are kept in a fixed posture. Common experience does in a great measure confirm the truth of this observation. We readily guess at a person's intention, or how he is affected to us, by his eyes. And any sudden change or emotion of the mind is presently followed by an alteration in the look. In speaking therefore upon pleasant and delightful subjects, the eyes are brisk and cheerful; as on the contrary, they sink and are languid in delivering any thing melancholy and sorrowful. This is so agreeable to nature, that before a person speaks, we are prepared with the expectation of one or the other from his different aspect. So likewise in anger, a certain vehemence and intenseness appears in the eyes, which, for want of proper words to express it by, we endeavour to represent by metaphors taken from fire, the most violent and rapid element, and say, in such cases, the *eyes sparkle*, *burn*, or are *inflamed*. In expressions of hatred or detestation, it is natural to alter the look, either by turning the eyes aside, or downwards. Virgil has very justly observed this: for when he describes Æneas meeting with Dido in the Elysian shades, and addressing her, he represents her disregard of him, by saying,

> Disdainfully she look'd; then turning round,
> Still fix'd her eyes unmov'd upon the ground.

She showed her resentment for his former treatment of her, by not vouchsafing to look on him. Indeed, the eyes are sometimes turned downwards upon other occasions, as to express modesty. And if at any time a particular object be addressed to, whatever it be, the eyes should be turned that way. And therefore Philostratus very deservedly ridicules a certain rhetorician as guilty of a solecism in gesture, who, upon saying, *O Jupiter!* turned his eyes downward; and when he said, *O Earth!* looked upward. A staring look has the appearance of giddiness and want of thought; and to contract the eyes, gives suspicion of craft and design. A fixed look may be occasioned from intenseness of thought, but at the same time shows a disregard to the audience; and a too quick and wandering motion of the eyes denotes levity and wantonness. A gentle and moderate motion of the eyes is therefore in common most suitable, always directed to some of the audience, and gradually turning from side to side with an air of respect and modesty, and looking them decently in the face, as in common discourse: Such a behaviour will of course draw an attention. As in conversation, when a person addresses us in an handsome and becoming manner, we presently put ourselves in a posture to give what he says a proper reception. But as all the passions are in the most lively manner expressed in the eyes, their motions ought to vary according to the different nature of these passions they are suited both to discover in the speaker, and convey to his hearers; since, as the quickest access to the mind is by the sight, a proper well-timed look will sometimes

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sometimes sooner effect this than it can be done by words; as in discharging a cannon we are struck with the light before we hear the sound.

As to the other parts of the body distinct from the head, the shoulders ought not to be elevated; for this is not only in itself indecent, but it likewise contracts the neck, and hinders the proper motion of the head. Nor, on the other hand, should they be drawn down, and depressed; because this occasions a stiffness both to the neck and the whole body. Their natural posture therefore is best, as being most easy and graceful. To shrug the shoulders has an abject and servile air; and frequently to heave them upwards and downwards is a very disagreeable sight.

A continued motion of the arms any way, is by all means to be avoided. Their action should generally be very moderate, and follow that of the hands, unless in very pathetic expressions, where it may be proper to give them a more lively spring.

The hands need never be idle. Quintilian seems to think them as necessary and powerful in action, as Cicero does the eyes. "The hands (says he), without which all gesture is lame and weak, have a greater variety of motions than can well be expressed; for they are almost equal to our words. Do not we desire with them, promise, call, dismiss, threaten, beseech, detest, fear, inquire, deny? Do not they express joy, sorrow, doubt, confession, penitence, measure, plenty, number, and time? Do not they excite, restrain, prove, admire, and shame? that in so great a variety of speech among all nations and countries, this seems to me the common language of all mankind." Thus far Quintilian. Now, all bodily motion is either upward or downward, to the right or left, forward or backward, or else circular. The hands are employed by the orator in all these, except the last. And as they ought to correspond with our expressions, so they ought to begin and end with them. In admiration, and addresses to heaven, they must be elevated, but never raised above the eyes; and in speaking of things below us, they are directed downwards. Side motion should generally begin from the left, and terminate gently on the right. In demonstrating, addressing, and on several other occasions, they are moved forward; and in threatening, sometimes thrown back. But when the orator speaks of himself, his right hand should be gently laid on his breast. When no other motion is necessary, the hands should be kept about as high as the breast, so as to make near a right angle with the arm. This is not only graceful, but likewise the most easy posture, and gives the least strain to the muscles. They should never be suffered to hang down, nor to loll upon the cushion or bar. The left hand should never move alone, but accommodate itself to the motions of the right. In motions to the left side, the right hand should not be carried beyond the left shoulder. In promises and expressions of compliment, the motion of the hands should be gentle and slow; but in exhortations and applause more swift. The hands should generally be open; but in expressions of compunction and anger they may be closed. All finical and trifling actions of the fingers ought to be avoided; nor should they be stretched out and expanded in a stiff and rigid posture, but kept easy and pliable.

Neither the breast nor the belly should be thrust out; which in itself looks ungainly, and hinders the free motion of the trunk; which ought not to be kept too stiff and upright, but easy and flexible, always suiting itself to the motions of the head and hands. The feet should continue steady, and not give the body a wavering and giddy motion by frequently shifting; though some persons fall into that habit without moving their feet. Curio, a Roman orator, as Cicero tells us, was addicted to this; which occasioned a friend of his once to pass a joke upon him, by asking, *Who that was talking out of a boat?* The jest is too plain to need explication; for every one knows the waving of a boat will give the body such a motion.

The gestures we have hitherto discoursed of, are such as naturally accompany our expressions. And we believe those we have mentioned, if duly attended to, will be found sufficient to answer all the purposes of our modern pronunciation. The ancients, indeed, used several more vehement actions and gestures than we are accustomed to; as we have formerly shown. Philip the Roman orator, as Cicero informs us, did not use to prepare his discourses; but spoke, as we say, *off-hand.* And he was wont to tell his friends, "he was never fit to talk till he had warmed his arm." He doubtless, therefore, used a more violent motion with his arms and hands than is common with us. And Cicero calls the arm projected *the orator's weapon.* Indeed, to extend or brandish the arm, carries in it an air of command and authority, which was not unbecoming the character of Philip, who was a person of the highest rank and quality. And therefore young orators, both among the Greeks and Romans, for a time used no motion of the arm, but kept it confined in their garment, as an argument of modesty, till age and experience allowed them to use greater freedom. Nor was it uncommon for the ancient orators to express the excess of their passions by tears. They thought nothing unbecoming that was natural: and judged it agreeable to the characters even of the bravest men, to be touched with a sense of humanity in great calamities: And therefore we find both Homer and Virgil make their greatest heroes shed tears on some occasions.

The other sort of gestures above mentioned are such as arise from imitation; as where the orator describes some action, or personates another speaking. But here great care is to be taken not to overact his part, by running into any ludicrous or theatrical mimicry. It is sufficient for him so to represent things of this nature, as may best convey the image of them in a lively manner to the minds of the hearers; without any such change either of his actions or voice as are not suitable to his own character.

Chap. IV. *Some particular Rules for the Voice and Gesture.*

131 Rules for the voice and gesture.

The subject of pronunciation is of so great importance to an orator, that it can neither be too clearly laid down, nor too strongly inculcated. If we inquire into the causes of that surprising power it has over us, and by what means it so strongly affects us, this may in some measure appear by reflecting on the frame and constitution of human nature. For our infinitely wise and great Maker has so formed us, that not only the actions of the body are subject to the direction of the mind, but we are likewise endowed with various passions.

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passions and affections, that excite us to pursue those things which make for our happiness, and avoid others which are hurtful to us. And as we are made for society, we are also furnished with speech, which enables us to converse with one another. And such is the contrivance of our make, and influence of our minds upon the mechanism of our bodies, that we can not only communicate our thoughts to each other, but likewise our passions. For, as Cicero well observes, "Every motion of the mind has naturally its peculiar countenance, voice, and gesture; and the whole body, every position of the face, and sound of the voice, like the strings of an instrument, act agreeably to the impression they receive from the mind." Nor is this all: but as every one is differently affected himself, he is capable to make the like impressions upon others, and excite them to the same motions which he feels in himself. As when two instruments are set to the same pitch, the strings of the one being touched, produce in the other the like sound. This common sympathy in the human frame shows how necessary it is that an orator should not only in general be well acquainted with the rules of pronunciation, but likewise know how to use them as occasion requires; for a general knowledge of the rules of art is not of itself sufficient to perfect an artist, without a further acquaintance with the particular application of them to their several cases and circumstances. Thus, for instance, it is not enough for an orator to understand all the beauties and ornaments of language, and which of them are suited to form the several kinds of style, unless he can likewise accommodate each of those characters to their proper subject. And so likewise in pronunciation, he ought not only to know the several qualities of the voice, and proper gestures of the body, but also when and where to make use of them. For not only different subjects, but also different parts of the same discourse, and even particular expressions, often require a difference in the manner of pronunciation, both as to the voice and gesture. Having therefore treated on both these parts of pronunciation in general, it may not be amiss now to consider how they are to be applied in each of the two respects last mentioned.

We shall begin with the parts of a discourse, and treat of them in their natural order. And here the view and design of the speaker in each of them will easily help us to see the proper manner of pronunciation.

Let us suppose then a person presenting himself before an assembly, in order to make a discourse to them. It cannot be decent immediately to begin to speak so soon as ever he makes his appearance. He will first settle himself, compose his countenance, and take a respectful view of his audience. This prepares them for silence and attention. To begin presently, and hurry on, without first allowing either himself or his hearers time to compose themselves, looks as if he was rather performing a task than had any design to please them; which will be very apt to make them as uneasy till he has done, as he seems to be himself. Persons commonly form some opinion of a speaker from their first view of him, which prejudices them either in his favour, or otherwise, as to what he says afterwards. A grave and sedate aspect inclines them to think him serious; that he has considered his subject, and may have something to offer worth their attention. A haughty and forbidding air occasions distaste, as it looks like disrespect. A wandering giddy countenance argues levity. A dejected drooping appearance is apt to raise contempt, unless where the subject is melancholy. And a cheerful aspect is a proper prelude to a pleasant and agreeable argument.

To speak low at first has the appearance of modesty, and is best for the voice; which, by rising gradually, will with more ease be carried to any pitch that may be afterwards necessary, without straining it. However, some variation of the voice is always proper to give it an harmony. Nay, and sometimes it is not improper for an orator to set out with a considerable degree of warmth, expressed by such an elevation of the voice, and gestures of the body, as are suited to represent the emotions of his mind. But this is not ordinarily the case. We have some few instances of this in Cicero; as in his oration for Roscius Amerinus, where the heinousness of the charge could not but excite his indignation against the accusers. And so likewise in that against Piso, and the two first against Catiline, which begin in the same manner, from the resentment he had conceived against their persons and conduct.

In the narration, the voice ought to be raised to somewhat an higher pitch. Matters of fact should be related in a very plain and distinct manner, with a proper stress and emphasis laid upon each circumstance, accompanied with a suitable address and motions of the body, to engage the attention of the hearers. For there is a certain grace in telling a story, by which those who are masters of it seldom fail to recommend themselves in conversation. The beauty of it consists in an easy and familiar manner of expression, attended with such actions and gestures as are suited to the nature of the things related, and help to enliven each particular circumstance and part of the discourse.

The proposition, or subject of the discourse, should be delivered with a very clear and audible voice. For if this be not plainly heard, all that follows in proof of it cannot well be understood. And for the same reason, if it be divided into several parts or branches, they should each be expressed very deliberately and distinctly. But as the design here is only information, there can be little room for gesture.

The confirmation admits of great variety both of the voice and gestures. In reasoning, the voice is quick and pungent, and should be enforced with suitable actions. And as descriptions likewise have often a place here, in painting out the images of things, the orator should so endeavour to adapt both his voice, and the motions of his body, particularly the turn of his eyes, and action of his hands as may best help the imagination of his hearers. Where he introduces another person speaking, or addresses to an absent person, it should be with some degree of imitation. And in dialogue the voice should alter with the parts. When he diverts from his subject by any digression, his voice should be lively and cheerful; since that is rather designed for entertainment than instruction.

In confutation, the arguments of the adverse party ought first to be repeated in a plain and distinct manner, that the speaker may not seem to conceal, or avoid the force of them, unless they appear trifling and

and unworthy of a serious answer; and then a facetious manner, both of expression and gesture, may be the properest way to confute them. For to attempt to answer in a grave and serious manner, what is in itself empty and ludicrous, is apt to create a suspicion of its having more in it than it really has. So when Tubero, in his accusation of Ligarius before Cæsar, had made it part of his charge, that Ligarius was in Africa during some part of the civil war between Cæsar and Pompey; Cicero, in his answer, not thinking it deserved a serious reply, contents himself with barely mentioning it ironically. For thus he begins his defence of Ligarius: "Cæsar, my kinsman Tubero has laid before you a new crime, and till this day unheard of, that Q. Ligarius was in Africa." Every one must easily perceive, by the manner in which these words were pronounced, that the design of them was to make the charge appear ridiculous. But caution should be used not to represent any argument of weight in a ludicrous way, lest by so doing the speaker should more expose himself than his adversary.

In the conclusion, both the voice and gesture should be brisk and sprightly, which may seem to arise from a sense of the speaker's opinion of the goodness of his cause, and that he has offered nothing but what is agreeable to reason and truth; as likewise from his assurance that the audience agree with him in the same sentiments. In every undertaking that requires care and thought, persons are apt at first to be sedate and moderate; but when it is drawing to an end, and is near finished, it is very natural to appear more gay. If an enumeration of the principal arguments of the discourse be convenient, as it sometimes is, where they are pretty numerous, or the discourse is long, they ought to be expressed in the most clear and forcible manner. And if there be an address to the passions, both the voice and gesture must be suited to the nature of them, of which more will be said presently.

We proceed now to the consideration of particular expressions. And what we shall offer here, will be first in relation to single words, then sentences, and lastly the passions.

132 I. Even in those sentences which are expressed in the most even and sedate manner, there is often one or more words which require an emphasis and distinction of the voice. Pronouns are often of this kind; as, *This is the man.* And such are many words that denote the circumstances and qualities of things. Such as heighten or magnify the idea of the thing to which they are joined, elevate the voice; as *noble*, *admirable*, *majestic*, *greatly*, and the like. On the contrary, those which lessen the idea, or debase it, depress the voice, or at least protract the tone; of which sort are the words *little*, *mean*, *poorly*, *contemptible*, with many others, Some tropes likewise, as metaphors and verbal figures, which consist in the repetition of a single word, should have a particular emphasis. As when Virgil says of the river Araxes, *It disdained a bridge*. And Nisus of himself in the same poet, *I, I am the man;* where the repeated word is loudest. This distinction of words, and giving them their proper emphasis, does not only render the expression more clear and intelligible, but very much contributes to the variation of the voice, and the preventing a monotony. And the different pronunciation of these words will also require a peculiar gesture.

II. In sentences, regard should be had to their length, and the number of their parts, in order to distinguish them by proper pauses. The frame and structure of the period ought likewise to be considered, that the voice may be so managed as to give it the most musical accent. Unless there be some special reason for the contrary, it should end louder than it begins. And this difference of tone between the end of the former sentence and the beginning of the next, not only helps to distinguish the sense, but adds to the harmony of the voice. And that the last syllables of a sentence might become more audible and distinct, was doubtless one reason why the ancient rhetoricians dislike short feet at the end of a period. In an antithesis, or a sentence consisting of opposite parts, one contrary must be louder than the other. As, "*He is gone, but by a gainful remove, from* painful labour to quiet rest; *from* unquiet desires *to happy* contentment; *from* sorrow *to* joy; *and from* transitory time *to* immortality." In a climax or gradation, the voice should rise with it. So, "*There is no enjoyment of* property *without* government; *no* government *without a* magistrate; *no* magistrate *without* obedience; *no* obedience *where every one acts as he* pleases." And so in other gradations of a different form. As, "*Since* concord *was lost*, friendship *was lost*, fidelity *was lost*, liberty *was lost*, all *was lost.*" And again, "*You would pardon him whom the* senate *hath condemned*, *whom* the people of Rome *have condemned*, *whom* all mankind *have condemned.*" We might mention several other figurative expressions, which require a particular conformation and management of the voice; but these, we presume, with some others we shall have occasion to name presently when we come to the passions, may be sufficient to guide us in the rest. But that it may appear more evidently how necessary a different inflection and variation of the voice is in most sentences, give us leave to show how Quintilian illustrates it, by a passage which he takes from Cicero. The place is the beginning of Cicero's defence for Milo, and the words are these: "*Although I am apprehensive it may seem base to discover fear when I enter upon the defence of* a most courageous man, *and it may appear very indecent*, when Milo discovers more concern for the public safety than for his own, *not to show a greatness of mind equal to his cause*, *yet this new form of the court terrifies my eyes*, which cannot discern the ancient manner of the forum, and former custom of trials, *whatever way they look:* your bench is not surrounded with its usual attendants." This sentence consists of four members. And Quintilian supposes, that though these words are the beginning of a speech, and were accordingly expressed in a calm and submissive manner, yet that the orator used a great deal of variety in the pronunciation of their several parts. In the first member (as he imagines) his voice was more elevated in expressing the word, *a most courageous man*, than in those other parts of it, *I am apprehensive it may seem base*, and, *to discover fear*. In the second member he rose higher, in saying, *when Milo discovers more concern for the public safety than for his own;* and then again, as it were, checked himself in what follows, *not to show a greatness of mind equal*

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134 III. That the passions have each of them both a different voice and action, is evident from hence; that we know in what manner a person is affected, by the tone of his voice, though we do not understand the sense of what he says, or many times so much as see him: and we can often make the same judgment from his countenance and gestures. Love and esteem are expressed in a smooth and cheerful tone: but anger and resentment, with a rough, harsh, and interrupted voice; for when the spirits are disturbed and ruffled, the organs are moved unequally. Joy raises and dilates the voice, as sorrow sinks and contracts it. Cicero takes notice of a passage in an oration of Gracchus, wherein he bewails the death of his brother, who was killed by Scipio, which in his time was thought very moving: "*Unhappy man* (says he), *whither shall I betake myself? where shall I go?* Into the capitol? *that flows with my brother's blood.* Shall I go home; *and behold my unhappy mother all in tears and despair?*" Though Gracchus had a very ill design in that speech, and his view was to excite the populace against their governors, yet (as Cicero tells us) when he came to this passage, he expressed himself in such moving accents and gestures, that he extorted tears even from his enemies. Fear occasions a tremor and hesitation of the voice, and assurance gives it strength and firmness. Admiration elevates the voice, and should be expressed with pomp and magnificence: *O surprising clemency, worthy of the highest praise and greatest encomiums, and fit to be perpetuated in lasting monuments!* This is Cicero's compliment to Cæsar when he thought it for his purpose. And oftentimes this passion is accompanied with an elevation both of the eyes and hands. On the contrary, contempt sinks and protracts the voice. In the dispute between Cicero and Cecilius, which of them should accuse Verres, Cicero puts this contemptuous question to him: "How are you qualified, Cecilius, for such an undertaking? I will not ask, when you ever gave a proof of it, but when you so much as attempted? Do you consider the difficulty of managing a public cause?" with much more to the same purpose. Though such kind of expressions require little gesture, yet sometimes a motion of the hand may not be improper, to signify disdain or aversion. We may suppose Cicero to have acted thus in his defence of Rabirius. For to show his assurance of his client's cause, having used this expression in a very audible manner, "I wish I had it to say, that Rabirius had with his own hand killed Saturninus, who was an enemy to the Roman state," some persons in the crowd began to raise a clamour, just as of later times hissing has been practised on the like occasions. Upon which Cicero immediately replies, "This noise does not disturb me, but please me, since it shows, though there are some weak persons, yet they are but few." Then presently after follows the expression we refer to: "Why do not you cease your clamour, since it only discovers your folly, and the smallness of your number?" All exclamations should be violent. When we address to inanimate things, the voice should be higher than when to animated beings; and appeals to heaven must be made in a loftier tone than those to men.

These few hints for expressing the principal passions may, if duly attended to, suffice to direct our practice in others. Though, after all, it is impossible to gain a just and decent pronunciation of voice and gesture merely from rules, without practice and an imitation of the best examples. Which shows the wisdom of the ancients, in training up their youth to it, by the assistance of masters, to form both their speech and actions.

But there is one thing which ought always to be attended to; namely, that persons should well consider their own make and genius, especially with respect to the passions. We seldom find, that any actor can excel in all characters; but if he performs one well, he is deficient in another: And therefore they are commonly so prudent as to confine themselves to such as best suit them. The case is the same in an orator; who should therefore keep within those bounds which nature seems to have prescribed for him. Some are better fitted for action than others, and most for some particular actions rather than others; and what fits well upon one would appear very awkward in another. Every one, therefore, should first endeavour to know himself, and manage accordingly. Though in most cases nature may be much assisted and improved by art and exercise. See Professor Ward's *System of Oratory.*

Oratory, Orb. ORATORY, among the Romanists, a closet or like apartment near a bed-chamber, furnished with an altar, crucifix, &c. for private devotions.

ORB, in *Astronomy*, denotes a hollow globe or sphere.

ORB, in tactics, is the disposing of a number of soldiers in circular form of defence. The orb has been thought of consequence enough to employ the attention of the famous Marshal de Puysegur in his Art of War, who prefers this position to throw a body of infantry in an open country, to resist cavalry, or even a superior force of infantry; because it is regular, and equally strong,

strong, and gives an enemy no reason to expect better success by attacking one place than another. Cæsar drew his whole army in this form, when he fought against Labienus. The whole army of the Gauls was formed into an orb, under the command of Sabinus and Cotta, when fighting against the Romans. The orb was generally formed six deep.

ORBIT, in *Astronomy*, the path of a planet or comet, or the curve that it describes in its revolution round its central body; thus, the earth's orbit is the curve which it describes in its annual course round the sun, and usually called the *ecliptic*. See ASTRONOMY, *passim*.

ORCADES, the *Orkney Islands*. See ORKNEY.

ORCHARD, a garden department, consigned entirely to the growth of standard fruit-trees, for furnishing a large supply of the most useful kinds of fruit. For the particular management of the orchard, see GARDENING.

In the orchard you may have, as standards, all sorts of apple-trees, most sorts of pears and plums, and all sorts of cherries: which four species are the capital orchard fruits; each of them comprising numerous valuable varieties. But to have a complete orchard, you may also have quinces, medlars, mulberries, service-trees, filberts, Spanish nuts, berberries; likewise walnuts and chesnuts; which two latter are particularly applicable for the boundaries of orchards, to screen the other trees from the insults of impetuous winds and cold blasts. All the trees ought to be arranged in rows from 20 to 30 feet distance, as hereafter directed.

But sometimes orchards consist entirely of apple-trees, particularly in the cyder-making counties, where they are cultivated in very great quantities in large fields, and in hedge rows, for the fruit to make cyder for public supply.

And sometimes whole orchards of very considerable extent are entirely of cherry-trees. But in this case, it is when the fruit is designed for sale in some great city, as London, &c. for the supply of which city, great numbers of large cherry orchards are in some of the adjacent counties, but more particularly in Kent, which is famous for very extensive cherry-orchards; many of which are entirely of that sort called *Kentish cherry*, as being generally a great bearer; others are stored with all the principal sorts of cultivated cherries, from the earliest to the latest kinds.

A general orchard, however, composed of all the before-mentioned fruit-trees, should consist of a double portion of apple-trees or more, because they are considerably the most useful fruit, and may be continued for use the year round.

The utility of a general orchard, both for private use and profit, stored with the various sorts of fruit-trees, must be very great, as well as afford infinite pleasure from the delightful appearance it makes from early spring till late in autumn: In spring the various trees in blossom are highly ornamental; in summer, the pleasure is heightened by observing the various fruits advancing to perfection; and as the season advances, the mature growth of the different species arriving to perfection, in regular succession, from May or June, until the end of October, must afford exceeding delight, as well as great profit.

Of the Extent, Situation, and Soil for the Orchard.—As to the proper extent of ground for an orchard, this must be proportioned, in some measure, to the extent of land you have to work on, and the quantity of fruit required either for private use or for public supply; so that an orchard may be from half an acre to 20 or more in extent.

With respect to the situation and aspect for an orchard, we may observe very thriving orchards both in low and high situations, and on declivities and plains, in various aspects or exposures, provided the natural soil is good: we should, however, avoid very low damp situations as much as the nature of the place will admit; for in very wet soils no fruit trees will prosper, nor the fruit be fine: but a moderately low situation, free from copious wet, may be more eligible than an elevated ground, as being less exposed to tempestuous winds; though a situation having a small declivity is very desirable, especially if its aspect incline towards the east, south-east, or southerly, which are rather more eligible than a westerly aspect; but a north aspect is the worst of all for an orchard, unless particularly compensated by the peculiar temperament or good quality of the soil.

And as for soil, any common field or pasture that produces good crops of corn, grass, or kitchen-garden vegetables, is suitable for an orchard; if it should prove of a loamy nature, it will be a particular advantage: any soil, however, of a good quality, not too light and dry, or too heavy, stubborn, or wet, but of a medium nature, of a soft, pliant temperature, not less than one spade deep of good staple, will be proper for this purpose.

Preparation of the ground.—The preparation of the ground for the reception of trees, is by trenching; or, if for very considerable orchards, by deep ploughing; but trench-digging, one or two spades, as the soil will admit, is the most eligible, either wholly, or only for the present in the places where the lines of trees are to stand, a space of six or eight feet wide, all the way in each row, especially if it be grass-ground, and intended to be kept in the sward; or if any under-crops are designed to be raised, the ground may be wholly trenched at first: in either case trench the ground in the usual way to the depth of the natural soil; and if in grass, turn the sward clean to the bottom of each trench, which, when rotted, will prove an excellent manure.

In planting orchards, however, on grass-grounds, some only dig pits for each tree, capacious enough for the reception of the roots, loosening the bottom well, without the labour of digging any other part of the ground.

The ground must be fenced securely against cattle, &c. either with a good ditch and hedge, or with a paling-fence, as may be most convenient.

Method of planting the Trees.—The best season for planting all the sorts of fruit-trees is autumn, soon after the fall of the leaf, from about the latter end of October until December; or indeed it might be performed any time in open weather from October until March.

Choose principally full standards, with straight clean stems, six feet high; each with a branchy well-formed head, of from two or three to four or five years growth; and let several varieties of each particular species be chosen, that ripen their fruit at different times, from the earliest to the latest, according to the nature of the dif-

Orchard.

ferent sorts, that there may be a proper supply of every sort regularly during their proper season. Of apples and pears in particular, choose a much greater quantity of the autumnal and late ripening kinds than of the early sorts, but most of all of apples; for the summer-ripening fruit is but of short duration, only proper for temporary service; but the later ripening kinds keep sound some considerable time for autumnal use; and the latest sorts that ripen in October, continue in perfection for various uses all winter, and several sorts until the season of apples come again.

Having made choice of the proper sorts, and marked them, let them be taken up with the utmost care, so as to preserve all their roots as entire as possible; and when taken up, prune off any broken or bruised parts of the roots, and just tip the ends of the principal roots, in general, with the knife on the under side with a kind of slope outward.

If the trees have been already headed, or so trained as to have branched out into regular shoots to form each a proper head, they must be planted with the said heads entire, only retrenching or shortening any irregular or ill-placed shoot that takes an awkward direction, or grows across its neighbours, or such as may run considerably longer than all the rest, &c.

The arrangement of the trees in the orchard must be in rows, each kind separate, at distances according to the nature of the growth of the different sorts; but for the larger growing kinds, such as apples, pears, plums, cherries, &c. they should stand from 25 to 30 or 40 feet every way asunder, though 25 or 30 feet at most is a reasonable distance for all these kinds.

Each species and its varieties should generally be in rows by themselves, the better to suit their respective modes of growth: though for variety there may be some rows of apples and pears arranged alternately, as also of plumbs and cherries; and towards the boundaries there may be ranges of lesser growth, as quinces, medlars, filberts, &c. and the outer row of all may be walnut-trees, and some chesnuts, set pretty close to defend the other trees from violent winds.

According to the above distances, proceed to stake out the ground for making the holes for the reception of the trees, which if made to range every way, will have a very agreeable effect, and admit the currency of air, and the sun's influence, more effectually.

But in planting very extensive orchards, some divide the ground into large squares or quarters, of different dimensions, with intervals of 50 feet wide between; serving both as walks, and for admitting a greater currency of air; in different quarters planting different sorts of fruit, as apples in one, pears in another, plums and cherries in others, &c. and thus it may be repeated to as many quarters for each species and its varieties as may be convenient.

As to the mode of planting the trees: A wide hole must be dug for each tree, capacious enough to receive all the roots freely every way without touching the sides. When the holes are all ready, proceed to planting, one tree in each hole, a person holding the stem erect, whilst another trims in the earth, previously breaking it small, and casting it in equally all about the roots, frequently shaking the tree to cause the mould to settle in close about all the smaller roots and fibres, and so as to raise the tree gradually up, that the crown of the roots may be but two or three inches below the general surface; and when the hole is filled up, tread it gently, first round the outside, then near the stem of the tree, forming the surface a little hollow; and then, if on the top of all be laid some inverted turf to the width of the hole, forming it with a sort of circular bank, three or four inches high, it will support the tree, and guard the roots from drying winds and the summer's drought: observing that each tree stand perfectly upright, and that they range exactly in their proper rows.

Method of improving the Fruit.—The following method is said to have been successfully employed, by a German clergyman, in promoting the growth of young trees, and increasing the size and flavour of the fruit in orchards. Having planted several young plum trees in an orchard, he covered the ground, for some years, around the trunks, as far as the roots extended, with flax-shows, or the refuse of flax when it is scutched or heckled; by which means these trees, though in a grass-field, increased in a wonderful manner, and far excelled others planted in cultivated ground. As far as the shows reached, the grass and weeds were choked; and the soil under them was so tender and soft, that no better mould could have been wished for by a florist.

When he observed this, he covered the ground with the same substance, as far as the roots extended, around an old plum-tree, which appeared to be in a languishing state, and which stood in a grass-field. The consequences were, that it acquired a strong new bark, produced larger and better tasted fruit, and that those young shoots, which before grew up around the stem, and which it was every year necessary to destroy, were prevented from sprouting forth, as the covering of flax-shows impeded the free access of air at the bottom of the trunk.

In the year 1793, he transplanted, from seed-beds, into the nursery, several fruit-trees; the ground around some of which he covered, as above, with flax-shows. Notwithstanding the great heat of the summer, none of those trees where the earth was covered with shows died or decayed, because the shows prevented the earth under them from being dried by the sun. Of those trees, around which the ground was not covered as before mentioned, the fourth part miscarried; and those that continued alive were far weaker than the former.

The leaves which fall from trees in autumn may also be employed for covering the ground in like manner; but stones, or logs of wood must be laid on them, to prevent their being dispersed by the wind. In grass land, a small trench may be made around the roots of the tree, when planted, in order to receive the leaves. If flax-shows are used, this is not necessary; they lie on the surface of the ground so fast as to resist the force of the most violent storm. The leaves which our author found most effectual in promoting the growth and fertility of fruit trees, are those of the walnut-tree. Whether it is, that, on account of their containing a greater abundance of saline particles, they communicate manure to the ground, which thereby becomes tender under them; or that they attract nitrous particles from the atmosphere; or that, by both these means, they tend to nourish the tree both above and below.

Those who are desirous of raising tender exotic trees from the seed, in order to accustom them to our climate, may,

may, when they transplant them, employ flax-shows with great advantage. This covering will prevent the frost from making its way to the roots; and rats and mice, on account of the sharp prickly points of the flax-shows, will not be able to shelter themselves under them.

ORCHESTRA, in the Grecian theatres, was that part of the *proscenium* or stage where the chorus used to dance. In the middle of it was placed the *Λογειον* or *pulpit*. The orchestra was semicircular, and surrounded with seats. In the Roman theatres it made no part of the *scena*, but answered pretty nearly to the pit in our playhouses, being taken up with seats for senators, magistrates, vestals, and other persons of distinction. The actors never went down into it. See THEATRE.

ORCHIA LEX, instituted by Orchius the tribune in the year of Rome 566. Its intention was to limit the number of guests that were to be admitted in an entertainment; and it is also enforced, that during supper, which was the chief meal among the Romans, the doors of every house should be left open.

ORCHIS, FOOLSTONES; a genus of plants belonging to the gynandria class, and in the natural method giving name to the seventh order *Orchideæ*. See BOTANY *Index*.

ORCUS, god of the infernal regions, the same with Pluto, so called from the Greek word *ορχος*, signifying a "tomb or sepulchre," or from *ορκος*, "an oath by the river Styx." The ancients gave this name to all the divinities of the infernal regions, even to Cerberus. There was a river of the same name in Thessaly, which took its rise from the marshes of the Styx, and the waters of which were so thick, that they floated like oil upon the surface of the river Peneus, into which they discharged themselves. This river probably suggested to the poets the idea of the infernal abodes, which they denominated *Orcus*. This deity has been confounded with Charon. He had temple at Rome.

ORDEAL, an ancient form of trial. See TRIAL.—It was an appeal to the immediate interposition of divine power, and was particularly distinguished by the appellation of *judicium Dei*; and sometimes *vulgaris purgatio*, to distinguish it from the canonical purgation, which was by the oath of the party. There were two sorts of it more common than the rest, at least in Europe; fire-ordeal, and water-ordeal. The former was confined to persons of higher rank, the latter to the common people. Both these might be performed by deputy; but the principal was to answer for the success of the trial; the deputy only venturing some corporal pain, for hire or perhaps for friendship.

That the purgation by ordeal, of some kind or other, is very ancient, admits not of a doubt; and that it was very universal in the times of superstitious barbarity, is equally certain. It seems even to have been known to the ancient Greeks; for in the Antigone of Sophocles, a person suspected by Creon of a misdemeanour, declares himself ready "to handle hot iron and to walk over fire" in order to manifest his innocence; which the scholiast tells us was then a very usual purgation. And Grotius gives us many instances of water-ordeal in Bithynia, Sardinia, and other places. It seems, however, to be carried to a greater height among the Hindoos, than ever it has been in any nation or among any people, however rude or barbarous; for in a paper of the Asiatic Researches communicated by Warren Hastings, Esq. we find that the *trial by ordeal* among them is conducted in *nine* different ways: first by the balance; secondly, by fire; thirdly, by water; fourthly, by poison; fifthly, by the Cosha, or water in which an idol has been washed; sixthly, by rice; seventhly, by boiling oil; eighthly, by red-hot iron; ninthly, by images.

I. Ordeal by the balance is thus performed. The beam having been previously adjusted, the cord fixed, and both scales made perfectly even, the person accused and a Pandit fast a whole day; then, after the accused has been bathed in sacred water, the *homa*, or oblation, presented to fire, and the deities worshipped, he is carefully weighed; and when he is taken out of the scale, the Pandits prostrate themselves before it, pronounce a certain *mentra* or incantation, agreeably to the Sastras, and, having written the substance of the accusation on a piece of paper, bind it on his head. Six minutes after, they place him again in the scale; and, if he weigh more than before, he is held guilty; if less, innocent; if exactly the same, he must be weighed a third time; when, as it is written in the *Mitacshera*, there will certainly be a difference in his weight. Should the balance, though well fixed break down, this would be considered as a proof of his guilt.

II. For the fire-ordeal, an excavation, nine hands long, two spans broad, and one span deep, is made in the ground, and filled with a fire of pippal wood: into this the person accused must walk barefooted; and, if his foot be unhurt, they hold him blameless; if burned, guilty (A).

(A) In Europe fire-ordeal was performed either by taking up in the hand, unhurt, a piece of red-hot iron, of one, two, or three pounds weight; or else by walking, barefoot and blindfold, over nine red-hot plough-shares, laid lengthwise at unequal distances; and if the party escaped being hurt, he was adjudged innocent; but if it happened otherwise, as without collusion it usually did, he was then condemned as guilty. However, by this latter method Queen Emma, the mother of Edward the Confessor, is mentioned to have cleared her character, when suspected of familiarity with Alwyn bishop of Winchester. The first account we have of Christians appealing to the fire-ordeal, as a proof of their innocence, is that of Simplicius, bishop of Autun, who lived in the fourth century. This prelate, as the story is related, before his promotion to the episcopal order, had married a wife, who loved him tenderly, and who, unwilling to quit him after his advancement continued to sleep in the same chamber with him. The sanctity of Simplicius suffered, at least in the voice of fame, by the constancy of his wife's affection; and it was rumoured about, that the holy man, though a bishop, persisted, in opposition to the ecclesiastical canons, to taste the sweets of matrimony: upon which his wife, in the presence of a great concourse of people, took up a considerable quantity of burning coals, which she held in her clothes, and applied to her breasts, without the least hurt to her person or her garments, as the legend says; and her example being followed by her husband with the like

Ordeal. III. Water-ordeal is performed by causing the person accused to stand in a sufficient depth of water, either flowing or stagnant, to reach his navel; but care should be taken that no ravenous animal be in it, and that it be not moved by much air; a brahman is then directed to go into the water, holding a staff in his hand; and a soldier shoots three arrows on dry ground from a bow of cane; a man is next despatched to bring the arrow which has been shot farthest; and, after he has taken it up, another is ordered to run from the edge of the water; at which instant the person accused is told to grasp the foot or the staff of the brahman, who stands near him in the water, and immediately to dive into it. He must remain under water, till the two men who went to fetch the arrows are returned; for, if he raise his head or body above the surface before the arrows are brought back, his guilt is considered as fully proved. In the villages near Benares, it is the practice for the person who is to be tried by this kind of ordeal, to stand in water up to his navel, and then, holding the foot of a brahman, to dive under it as long as a man can walk 50 paces very gently; if, before the man has walked thus far, the accused rise above the water, he is condemned; if not, acquitted (B).

IV. There are two sorts of trial by poison; first, the pandits having performed their homa, and the person accused his ablution, two *rettis* and a half, or seven barley-corns of *vishanaga*, a poisonous root, or of *sauc'hya*, that is, white arsenic, are mixed in eight *mashas*, or 64 *rettis*, of clarified butter, which the accused must eat from the hand of a brahman: if the poison produce no visible effect, he is absolved; otherwise condemned. Secondly, the hooded snake, called *nagga*, is thrown into a deep earthen pot, into which is dropped a ring, a seal, or a coin; this the person accused is ordered to take out with his hand; and, if the serpent bite him, he is pronounced guilty; if not, innocent.

V. Trial by the cosha is as follows: the accused is made to drink three draughts of the water, in which the images of the sun, of Devi, and other deities, have been washed for that purpose; and if, within 14 days, he has any sickness or indisposition, his crime is considered as proved.

VI. When several persons are suspected of theft, some dry rice is weighed with the sacred stone called *salgram*, or certain *slocas* are read over it; after which the suspected persons are severally ordered to chew a quantity of it: as soon as they have chewed it, they are to throw it on some leaves of *pippal*, or, if none be at hand, on some *b'hurja patra*, or bark of a tree, from Nepal or Cashmir. The man, from whose mouth the rice comes dry or stained with blood, is holden guilty; the rest is acquitted.

VII. The ordeal by *hot oil* is very simple: when it is heated sufficiently, the accused thrusts his hand into it; and, if he be not burned, is held innocent (C).

VIII.

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like success, the silly multitude admired the miracle, and proclaimed the innocence of the loving pair. A similar trick was played by St Brice, in the fifth century. *Mosh. Eccl. Hist.* vol. ii.

(B) A very peculiar species of water-ordeal is said to prevail among the Indians on the coast of Malabar. A person accused of an enormous crime is obliged to swim over a large river abounding with crocodiles; and if he escapes unhurt, he is esteemed innocent.

At Siam, besides the usual methods of fire and water-ordeal, both parties are sometimes exposed to the fury of a tiger let loose for that purpose; and if the beast spares either, that person is accounted innocent; if neither, both are held to be guilty; but if he spares both, the trial is incomplete, and they proceed to a more certain criterion.

In Europe water-ordeal was performed, either by plunging the bare arm up to the elbow in boiling-water, and escaping unhurt thereby, or by casting the person suspected into a river or pond of cold water; and if he floated therein without any action of swimming, it was deemed an evidence of his guilt; but if he sunk, he was acquitted. It is easy to trace out the traditional relics of this water-ordeal, in the ignorant barbarity still practised in many countries to discover witches, by casting them into a pool of water, and drowning them to prove their innocence. And in the eastern empire the fire-ordeal was used for the same purpose by the emperor Theodore Lascaris; who, attributing his sickness to magic, caused all those whom he suspected to handle the hot iron: thus joining (as has been well remarked) to the most dubious crime in the world, the most dubious proof of innocence.

(C) This species of trial by ordeal is thus performed: The ground appointed for the trial is cleared and rubbed with cow-dung, and the next day at sunrise the *Pandit* worships Ganesa or the Hindoo Janus, presents his oblations, and pays adoration to other deities, conformably to the *Sástra*: then having read the incantation prescribed, he places a round pan of gold, silver, copper, iron, or clay, with a diameter of sixteen fingers, and four fingers deep, and throws into it one *sér*, or eighty *sicca* weight, of clarified butter or oil of *sesamum*. After this a ring of gold, or silver, or iron, is cleaned and washed with water, and cast into the oil; which they proceed to heat, and when it is very hot put into it a fresh leaf of *pippala*, or of *bilwa*: when the leaf is burned, the oil is known to be sufficiently hot. Then, having pronounced a *mentra* over the oil, they order the party accused to take the ring out of the pan; and if he take it out without being burned, or without a blister in his hand, his innocence is considered as proved; if not, his guilt. It is reported that this custom, with some slight variations, still prevails among the Indians on the coast of Malabar. The process there is said to begin after the accused person has been thoroughly washed in the presence of the prince of the country, the priests, &c.:—the pot is filled with boiling lead; and the accused must take the ring out three times successively. On the Malabar coast, this ordeal seems only to be used when the person is accused of a capital crime; for after the process the arm is bound with cloth and sealed; and after several days, being brought out publicly, and the arm inspected, if it is found burnt he is instantly put to death; if not, his accuser undergoes the same trial, and being burnt, forfeits his life.

Ordeal.

VIII. In the same manner they make an *iron ball*, or the *head of a lance*, red hot, and place it in the hands of the person accused; who, if it burn him not, is judged guiltless.

IX. To perform the ordeal by *dharmách*, which is the name of the *slóca* appropriated to this mode of trial, either an image, named *Dharma*, or the genius of justice, is made of silver, and another, called *Adharma*, of clay or iron, both of which are thrown into a large earthen jar; and the accused having thrust his hand into it, is acquitted if he bring out the silver image, but condemned if he draw forth the iron; or, the figure of a deity is painted on white cloth, and another on black; the first of which they name *dharma*, and the second *adharma*: these are severally rolled up in cow-dung, and thrown into a large jar without having ever been shown to the accused; who must put his hand into the jar, and is acquitted or convicted as he draws out the figure on white or on black cloth.

Though we have proceeded thus far, we have not exhausted Mr Hastings's communication. He goes on to show (to greater extent than our limits permit us to follow him) the manner in which each ordeal above mentioned was executed, giving examples, and unfolding other particulars of some importance in developing the nature of these barbarous customs. For these particulars, however, we must refer to the book itself. But as this subject unquestionably occupies an important department in the history of human superstition, we shall give the Indian law of ordeal from the same paper; when we shall introduce some further particulars concerning this extraordinary custom, which are not to be found in the above account, but which deserve to be noticed.

"1. The balance, fire, water, poison, the idol—these are the ordeals used here below for the proof of innocence, when the accusations are heavy, and when the accuser offers to hazard a mulct, (if he should fail):

2. Or one party may be tried, if he please, by ordeal, and the other must then risk an amercement; but the trial may take place even without any wager, if the crime committed be injurious to the prince.

3. The sovereign having summoned the accused while his clothes are yet moist from bathing, at sunrise, before he has broken his fast, shall cause all trials by ordeal to be conducted in the presence of *Bráhmans*.

4. The balance is for women, children, old men, the blind, the lame, *Bráhmans*, and the sick; for the *Súdra*, fire or water, or seven barley-corns of poison.

5. Unless the loss of the accuser amount to a thousand pieces of silver, the accused must not be tried by the red-hot ball, nor by poison, nor by the scales; but if the offence be against the king, or if the crime be heinous, he must acquit himself by one of those trials in all cases.

6. He who has recourse to the balance must be attended by persons experienced in weighing, and go down into one scale, with an equal weight placed on the other, and a groove (with water in it) marked on the beam.

7. 'Thou, O balance, art the mansion of truth; thou wast anciently contrived by deities: declare the truth, therefore, O giver of success, and clear me from all suspicion.

8. 'If I am guilty, O venerable as my own mother, then sink me down, but if innocent raise me aloft.' Thus shall he address the balance.

9. If he sink he is convicted, or if the scales be broken: but if the string be not broken, and he rise aloft, he must be acquitted.

10. On the trial by fire, let both hands of the accused be rubbed with rice in the husk, and well examined: then let seven leaves of the *Aswatt'ha* (the religious fig-tree) be placed on them, and bound with seven threads.

11. 'Thou, O fire, pervadest all beings: O cause of purity, who givest evidence of virtue and of sin, declare the truth in this my hand.

12. When he has pronounced this, the priest shall place in both his hands an iron ball, red-hot, and weighing fifty *palas* (D).

13. Having taken it, he shall step gradually into seven circles, each with a diameter of sixteen fingers, and separated from the next by the same space.

14. If, having cast away the hot ball, he shall again have his hands rubbed with rice in the husk, and shall show them unburned, he will prove his innocence. Should the iron fall during the trial, or should a doubt arise (on the regularity of the proceedings), he must be tried again.

15. 'Preserve me, O Varuna, by declaring the truth.' Thus having invoked the god of waters, the accused shall plunge his head into the river or pool, and hold both thighs of a man, who shall stand in it up to his navel:

16. A swift runner shall then hasten to fetch an arrow shot at the moment of his plunging; and if, while the runner is gone, the priest shall see the head of the accused under water, he must be discharged as innocent.

17. 'Thou, O poison, art the child of Brahmâ, steadfast in justice and in truth: clear me then from this heavy charge, and if I have spoken truly, become nectar to me.'

18. Saying this, he shall swallow the poison *Sárnga*, from the tree which grows on the mountain *Himálaya*; and if he digests it without any inflammation, the prince shall pronounce him guiltless.

19. Or the priest shall perform rites to the image of some tremendous deity; and, having bathed the idol, shall make the accused to drink three handfuls of the water that has dropped from it.

20. If in fourteen days after he suffers no dreadful calamity from the act of the deity or of the king, he must indubitably be acquitted."

The superstitious weakness of mankind, when left to themselves, is astonishing. There is indeed nothing so absurd but they may be made most firmly to believe, nor so impious but they will do. Nor can a more notorious instance of the truth of this assertion be

(D) A *pala* is four *carshas*, and a *carsha* eighty *racticás* or seeds of the *gungà* creeper, each weighing above a grain and a quarter, or correctly, $1\frac{5}{16}$ gr.

be possibly given than that of the trial by ordeal. The gross absurdity as well as impiety of pronouncing a man guilty unless he was cleared by a miracle, and of expecting that all the powers of nature should be suspended by an immediate interposition of Providence to save the innocent, when it was even presumptuously required, is self-evident. Yet the origin of it may be traced as well to necessity as to superstition. At the time in which it originated in England, as well as in other countries of Europe, it was no easy matter for an innocent person, when accused of guilt, to get himself cleared by the then established mode of trial. (See TRIAL). It was therefore natural for superstition to fly to Heaven for those testimonies of innocence which the absurdity of human laws often prevented men from obtaining in the ordinary way; and in this way doubtless did the trial by ordeal commence: and thus begun by necessitous superstition, it was fostered by impious priestcraft and unjust power. There was during all the processes great room for collusion and deceit; and there can be no question but it was often practised: it could not therefore on any account, or in any case, be a sign of innocence or of guilt.

Besides those particular methods of trial which we have already mentioned, there were some few more common in European countries; as the judicial combat —the ordeal of the cross—the ordeal of the corsned.

The judicial combat was well suited to the genius and spirit of fierce and warlike nations, and was, as we may reasonably expect, one of the most ancient and universal modes of trial. We know that it was exceedingly common in Germany in very remote ages. It was also used in some countries on the continent at pretty early periods: it is not, however, mentioned in any of the Anglo-Saxon laws; and it does not appear to have been much used in England till after the Conquest. There are, however, two remarkable instances of it upon record, which we shall give in the words of Dr Henry: "Henry de Essex, hereditary standard-bearer of England, fled from a battle in Wales, A. D. 1158, threw from him the royal standard, and cried out, with others, that the king was slain. Some time after, he was accused with having done this with a treasonable intention, by Robert de Montfort, another great baron, who offered to prove the truth of his accusation by combat. Henry de Essex denied the charge, and accepted the challenge. When all preliminaries were adjusted, this combat was accordingly fought, in the presence of Henry II. and all his court. Essex was defeated, and expected to be carried out to immediate execution. But the king, who was no friend to this kind of trial, spared his life, and contented himself with confiscating his estate, and making him a monk in the abbey of Reading.

"The priory of Tinmouth, in Northumberland, was a cell of the abbey of St Alban's. One Simon of Tinmouth claimed a right to two corrodies, or the maintenance of two persons in the priory, which the prior and monks denied. This cause was brought before the abbot of St Alban's and his court-baron, who appointed it to be tried by combat on a certain day, before him and his barons. Ralf Gubion, prior of Tinmouth, appeared at the time and place appointed, attended by his champion, one William Pegun, a man of gigantic stature. The combat was fought, Pegun was defeated, and the prior lost his cause; at which he was so much chagrined, that he immediately resigned his office. This judicial combat is the more remarkable, that it was fought in the court of a spiritual baron, and that one of the parties was a priest."

We need scarcely add, that this detestable form of trial was the foundation of the no less detestable crime of duelling, which so much disgraces our age and nation; which is defended only by ignorance, false honour, and injustice; which is a relick of barbarous superstition; and which was absolutely unknown to those brave and generous nations, the Greeks and Romans, which it is so much the fashion to admire, and who in this particular so well merit our imitation. See DUEL.

It was so much the custom in the middle ages of Christianity, to respect the cross even to superstition, that it would have been indeed wonderful if the same ignorant bigotry had not converted it into an ordeal; accordingly we find it used for this purpose, in so many different ways as almost to preclude description. We shall, however, transcribe, for the satisfaction of our readers, Dr Henry's account of it, and of the corsned: "In criminal trials, the judgment of the cross was commonly thus conducted. When the prisoner had declared his innocence upon oath, and appealed to the judgment of the cross, two sticks were prepared exactly like one another: the figure of the cross was cut on one of these sticks, and nothing on the other: each of them was then wrapped up in a quantity of fine white wool, and laid on the altar, or on the relicks of the saints; after which a solemn prayer was put up to God, that he would be pleased to discover, by evident signs, whether the prisoner was innocent or guilty. These solemnities being finished, a priest approached the altar, and took up one of the sticks, which was uncovered with much anxiety. If it was the stick marked with the cross, the prisoner was pronounced innocent: if it was the other, he was declared guilty. When the judgment of the cross was appealed to in civil causes, the trial was conducted in this manner: The judges, parties, and all concerned, being assembled in a church, each of the parties chose a priest, the youngest and stoutest that he could find, to be his representative in the trial. These representatives were then placed one on each side of some famous crucifix; and, at a signal given, they both at once stretched their arms at full length, so as to form a cross with their body. In this painful posture they continued to stand while divine service was performing; and the party whose representative dropped his arms first lost his cause.

"The corsned, or the consecrated bread and cheese, was the ordeal to which the clergy commonly appealed when they were accused of any crimes; in which they acted a very prudent part, as it was attended with no danger or inconveniency. This ordeal was performed in this manner: A piece of barley bread, and a piece of cheese, were laid upon the altar, over which a priest pronounced certain conjurations, and prayed with great fervency, that if the person accused was guilty, God would send his angel Gabriel to stop his throat, that he might not be able to swallow that bread and cheese. These prayers being ended, the culprit approached the altar, Ordeal.

altar, took up the bread and cheese, and began to eat it. If he swallowed freely, he was declared innocent; but if it stuck in his throat, and he could not swallow (which we may presume seldom or never happened), he was pronounced guilty."

There were besides these a variety of other ordeals practised in Christian countries, many of which retain the same names as among Pagans, and differ only in the mode of execution. In all nations of Christians where those trials were used, we find the clergy engaged in them. Indeed, in England, so late as King John's time, we find grants to the bishops and clergy to use the *judicium ferri, aquæ, et ignis*. And, both in England and Sweden, the clergy presided at this trial, and it was only performed in the churches or in other consecrated ground: for which Stiernhook gives the reason, *Non defuit illis operæ et laboris pretium; semper enim ab ejusmodi judicio aliquid lucri sacerdotibus obveniebat*. But, to give it its due praise, we find the canon law very early declaring against trial by ordeal, or *vulgaris purgatio*, as being the fabric of the devil, *cum sit contra præceptum Domini, Non tentabis Dominum Deum tuum*. Upon this authority, though the canons themselves were of no validity in England, it was thought proper (as had been done in Denmark above a century before) to disuse and abolish this trial entirely in our courts of justice, by an act of Parliament in 3 Hen. III. according to Sir Edward Coke, or rather by an order of the king in council.

It may still perhaps be a *postulatum* with some of our readers how the effects of these trials were evaded, and how it was possible to appear to do, what we know could not be really done, without material injury to the persons concerned: on this subject the learned historian whom we have already quoted, observes with regard to the ordeals in ancient Britain, which, *mutatis mutandis*, will answer for others, that, "If we suppose few or none escaped conviction who exposed themselves to those fiery trials, we shall be very much mistaken. For the histories of those times contain innumerable examples of persons plunging their naked arms into boiling water, handling red-hot balls of iron, and walking upon burning ploughshares, without receiving the least injury. Many learned men have been much puzzled to account for this, and disposed to think that Providence graciously interposed, in a miraculous manner, for the preservation of injured innocence. But if we examine every circumstance of those fiery ordeals with due attention, we shall see sufficient reason to suspect that the whole was a gross imposition on the credulity of mankind. The accused person was committed wholly to the priest who was to perform the ceremony, three days before the trial, in which he had time enough to bargain with him for his deliverance, and give him instructions how to act his part. On the day of trial, no person was permitted to enter the church but the priest and the accused till after the iron was heated, when twelve friends of the accuser, and twelve of the accused, and no more, were admitted, and ranged along the wall on each side of the church, at a respectful distance. After the iron was taken out of the fire, several prayers were said; the accused drank a cup of holy water, and sprinkled his hand with it, which might take a considerable time if the priest was indulgent. The space of nine feet was measured by the accused himself with his own feet, and he would probably give but scanty measure. He was obliged only to touch one of the marks with the toe of his right foot, and allowed to stretch the other foot as far towards the other mark as he could, so that the conveyance was almost instantaneous. His hand was not immediately examined, but wrapped in a cloth prepared for that purpose three days. May we not then, from all these precautions, suspect that these priests were in possession of some secret that secured the hand from the impressions of such a momentary touch of hot iron, or removed all appearance of these impressions in three days; and that they made use of this secret when they saw reason? Such readers as are curious in matters of this kind may find two different directions for making ointments that will have this effect, in the work here quoted *. What greatly strengthens these suspicions is, that we meet with no example of any champion of the church who suffered the least injury from the touch of hot iron in this ordeal: but when any one was so fool-hardy as to appeal to it, or to that of hot water, with a view to deprive the church of any of her possessions, he never failed to burn his fingers, and lose his cause."

* *DuCange, Gloss.* tom. iii. p. 397.

To this we shall add what the learned Beckmann has said concerning the imposition that was probably practised in the ordeal by fire. "I am not acquainted with every thing that concerns the trial by ordeal, when persons accused were obliged to prove their innocence by holding in their hands red-hot iron; but I am almost convinced that this was also a juggling trick of the popes, which they employed as might best suit their views. It is well known that this mode of exculpation was allowed only to weak persons, who were unfit to wield arms, and particularly to monks and ecclesiastics, to whom, for the sake of their security, that by single combat was forbidden. The trial itself took place in the church, entirely under the inspection of the clergy; mass was celebrated at the same time: the defendant and the iron were consecrated by being sprinkled with holy-water; the clergy made the iron hot themselves; and they used all these preparatives, as jugglers do many motions, only to divert the attention of the spectators. It was necessary that the accused person should remain at least three days and three nights under their immediate care, and continue as long after. They covered his hands both before and after the proof; sealed and unsealed the covering: The former, as they pretended, to prevent the hands from being prepared any how by art; the latter, to see if they were burnt.

Some artificial preparation was therefore known, else no precautions would have been necessary. It is highly probable, that during the three first days the preventive was applied to those persons whom they wished to appear innocent; and that the three days after the trial were requisite to let the hands resume their natural state. The sacred sealing secured them from the examination of presumptuous unbelievers; for to determine whether the hands were burnt, the three last days were certainly not wanted. When the ordeal was abolished, and this art rendered useless, the clergy no longer kept it a secret. In the 13th century, an account of it was published by Albertus Magnus, a Dominican monk

Ordeal, Order. monk (A). If his receipt be genuine, it seems to have consisted rather in covering the hands with a kind of paste than in hardening them. The sap of the *althæa* (marshmallow), the slimy seeds of the flea-bane, which is still used for stiffening by the hat-makers and silk-weavers, together with the white of an egg, were employed to make the paste adhere. And by these means the hands were as safe as if they had been secured by gloves.

"The use of this juggling trick is very old, and may be traced back to a Pagan origin. In the Antigone of Sophocles, the guards placed over the body of Polynices, which had been buried contrary to the orders of Creon, offered, in order to prove their innocence, to submit to any trial. We will, said they, take up red-hot iron in our hands, or walk through fire*.

* Vol. iii. 297.

ORDER, in *Architecture*, is a system of the several members, ornaments, and proportions of columns and pilasters; or a regular arrangement of the projecting parts of a building, especially the column, so as to form one beautiful whole. See ARCHITECTURE.

ORDER is also used for a division or class of any thing: thus the tribe of animals called *birds* is subdivided into six orders. See ORNITHOLOGY.

ORDER, in *Rhetoric*, is the placing of each word and member of a sentence in such a manner, as will most contribute to the force, beauty, or evidence of the whole; according to the genius and custom of different languages. With regard to order, we may observe in general, that, in English, the nearer we keep to the natural or grammatical order, it is generally the best; but in Latin, we are to follow the use of the best writers; a joint regard being always had to the judgment of the ear, and the perspicuity of the sense, in both languages.

ORDER is also used for a class or division of the members of the body of a state; with regard to assemblies, precedency, &c.

In this sense, order is a kind of dignity, which, under the same name, is common to several persons; and which, of itself, does not give them any particular public authority, but only rank, and a capacity of arriving at honours and employments.

To abridge this definition, order may be said to be a dignity attended with an aptitude for public employ. By which it is distinguished from an office, which is the exercise of a public trust.

In this sense, nobility is an order, &c. The clericate is also an order, &c.

ORDER is also the title of certain ancient books, containing the divine office, with the order and manner of its performance.

Roman order is that wherein are laid down the ceremonies which obtain in the Romish church. See RITUAL.

ORDER, in *Botany*, is a name given to a subdivision of plants in the Linnæan system. See BOTANY.

Order. ORDERS, by way of eminency, or *Holy ORDERS*, denote a character peculiar to ecclesiastics, whereby they are set apart for the ministry. See ORDINATION.

This the Romanists make their sixth sacrament.

In no reformed church are there more than three orders; viz. bishops, priests, and deacons. In the Romish church there are seven, exclusive of the episcopate, all which the council of Trent enjoins to be received, and believed, on pain of anathema.

They are distinguished into petty, or secular orders; and major, or sacred orders.

ORDERS, the petty, or minor, are for; viz. those of doorkeeper, exorcist, reader, and acolyth.

Those in petty orders may marry without any dispensation: in effect, the petty orders are looked on as little other than formalities, and as degrees necessary to arrive at the higher orders. Yet the council of Trent is very serious about them; enjoins that none be admitted into them without understanding Latin; and recommends it to the bishops, to observe the intervals of conferring them, that the persons may have a sufficient time to exercise the function of each order; but it leaves the bishops a power of dispensing with those rules; so that the four orders are usually conferred the same day, and only make the first part of the ceremony of ordination.

The Greeks disavow these petty orders, and pass immediately to the subdeaconate; and the reformed to the deaconate.

Their first rise Fleury dates in the time of the emperor Justinian. There is no call nor benefice required for the four petty orders; and even a bastard may enjoy them without any dispensation; nor does a second marriage disqualify.

ORDERS, sacred, or major, we have already observed, are three: viz. those of deacon, priest, and bishop.

The council of Trent, retrieving the ancient discipline, forbids any person being admitted to the major orders, unless he be in peaceable possession of a benefice sufficient for a decent subsistence; allowing no ordinations on patrimonies or pensions, except where the bishop judges it for the service of the church.

A person is said to be promoted to orders *per saltum*, when he has not before passed the inferior orders. The council of Constantinople forbids any bishop being ordained without passing all the degrees; yet church-history furnishes us with instances of bishops consecrated, without having passed the order of priesthood; and Panormus still thinks such an ordination valid.

Military ORDERS, are companies of knights, instituted by kings and princes, either for defence of the faith, or to confer marks of honour, and make distinctions among their subjects.

Religious ORDERS, are congregations or societies of monastics, living under the same superior, in the same manner, and wearing the same habit. Religious orders

(A) In his work *De Mirabilibus Mundi*, at the end of his book *De Secretis Mulierum*, Amstelod. 1702, 12mo, p. 100. Experimentum mirabile quod facit hominem ire in ignem sine læsione, vel portare ignem vel ferrum ignitum sine læsione in manu. Recipe succum bismalvæ, et albumen ovi, et semen psylli et calcem, et pulveriza, et confice cum illo albumine ovi succum raphani; commisce; ex hac confectione illineas corpus tuum vel manum, et dimitte siccari, et postea iterum illineas, et post hoc poteris audacter sustinere ignem sine nocumento.

ders may be reduced to five kinds; viz. monks, canons, knights, mendicants, and regular clerks. See MONK, CANON, &c.

Father Mabillon proves, that till the ninth century, almost all the monasteries in Europe followed the rule of St Benedict; and that the distinction of orders did not commence till upon the reunion of several monasteries into one congregation: that St Odo, abbot of Cluny, first began this reunion, bringing several houses under the dependence of Cluny: that, a little afterwards, in the 11th century, the Camaldulians arose; then, by degrees, the congregation of Vallombrosa; the Cistercians, Carthusians, Augustines; and at last in the 13th century, the Mendicants. He adds, that Lupus Servatus, abbot of Ferrieres, in the ninth century, is the first that seems to distinguish the order of St Benedict from the rest, and to speak of it as a particular order.

White ORDER denotes the order of regular canons of St Augustine. See AUGUSTINES.

Black ORDER denoted the order of BENEDICTINES.

These names were first given these two orders from the colour of their habit; but are disused since the institution of several other orders, who wear the same colours.

Gray ORDER was the ancient name of the CISTERCIANS; but since the change of the habit, the name suits them no more.

ORDERS, religious military, are those instituted in defence of the faith, and privileged to say mass; and who are prohibited marriage, &c.

Of this kind are the knights of Malta, or of St John of Jerusalem. Such also were the knights Templars, the knights of Calatrava, knights of St Lazarus, Teutonic knights, &c. See MALTA, TEMPLAR, &c.

Father Putignani accounts those military orders where marriage is not allowed, real religious orders. Papebroch says, it is in vain to search for military orders before the 12th century.

ORDERS, in a military sense, all that is lawfully commanded by superior officers. Orders are given out every day, whether in camp, garrison, or on a march, by the commanding officer; which orders are afterwards given to every officer in writing by their respective serjeants.

ORDINAL, a book containing the order or manner of performing divine service. See RITUAL.

ORDINAL Numbers, those which express order, as 1st, 2d, 3d, &c.

ORDINANCE or ORDONNANCE, a law, statute, or command of a sovereign or superior; thus the acts of parliament are sometimes termed *ordinances of parliament*, as in the parliament rolls. Though in some cases we find a difference made between the two; ordinances being only temporary things, by way of prohibition; and capable of being altered by the commons alone: whereas an act is a perpetual law, and cannot be altered by king, lords, and commons.

Coke asserts, that an ordinance of parliament differs from an act, as the latter can only be made by the king, and the threefold consent of the estates; whereas the former may be made by one or two of them.

ORDINANCE of the Forest, is a statute made in the 34th year of Henry I. relating to forest-matters.

In the French jurisprudence, ordinances are such laws as are established by the king's authority alone. All ordonnances begin with, *à tous presens, et à venir salut*.

ORDINARY, in general, signifies common, usual; thus, an ambassador, or envoy in ordinary, is one sent to reside statedly, and for a number of years, in the court of some foreign prince or state, in order to keep up a good understanding, and watch over the interest of his own nation.—This term is also applied to several officers in the king's household, who attended on common occasions. Thus we say, physician in ordinary, &c.

ORDINARY, in naval language, denotes the establishment of the persons employed by government to take charge of the ships of war, which are laid up in the several harbours adjacent to the royal dock-yards. These are principally composed of the warrant officers of the said ships, as the gunner, boatswain, carpenter, deputy-purser, and cook, and three servants. There is besides a crew of labourers inrolled in the list of the ordinary, who pass from ship to ship occasionally, to pump, moor, remove, or clean them, whenever it is necessary.

The term *ordinary* is also applied sometimes to the ships themselves; it is likewise used to distinguish the inferior sailors from the most expert and diligent. The latter are rated *able* on the navy books, and have higher pay than those who are rated *ordinary*.

ORDINARY, in common or canon law, means one who has ordinary or immediate jurisdiction in matters ecclesiastical, in any place. In this sense archdeacons are ordinaries, but the appellation is most frequently applied to the bishop of the diocese, who has of course the ordinary ecclesiastical jurisdiction, and the collation to benefices within such diocese. There are some chapels, chapters, abbeys, &c. exempted from the jurisdiction of the ordinary. The arsbbishop is ordinary of the whole province, to visit, and receive appeals from the inferior judicatures. The Romish writers on canon law call the pope by way of eminence *ordinary of ordinaries*, since by the Lateran council he has usurped the right of collating, by probation, to all benefices; in exclusion of the common collators.

ORDINARY of Assizes and *Sessions*, was a deputy of the bishop of the diocese, anciently appointed to give malefactors their neck-verses, and judge whether they read or not: also to perform divine service for them, and assist in preparing them for death. So the

ORDINARY of Newgate, is one who is attendant in ordinary upon the condemned malefactors in that prison, to prepare them for death; and he records the behaviour of such persons.

ORDINARY, or *Honourable ORDINARY*, in *Heraldry*, a denomination given to certain charges properly belonging to that art. See HERALDRY, Chap. III. sect. i.

ORDINATES, in *Geometry* and *Conics*, are lines drawn from any point of the circumference of an ellipsis, or other conic section, perpendicularly across the axis, to the other side. See *CONIC-Sections*.

ORDINATION, the act of conferring holy orders, or of initiating a person into the priesthood by prayer and the laying on of hands.

Ordination has always been esteemed a principal prerogative of bishops, and they still retain the function as as a mark of spiritual sovereignty in their diocese. Without ordination, no person can receive any benefice, parsonage, vicarage, &c. A person must be 23 years of age, or near it, before he can be ordained deacon, or have any share in the ministry; and full 24 before he can be ordained priest, and by that means be permitted to administer the holy communion. A bishop, on the ordination of clergymen, is to examine them in the presence of the ministers, who, in the ordination of priests, but not of deacons, assist him at the imposition of hands; but this is only done as a mark of assent, not because it is thought necessary. In case any crime, as drunkenness, perjury, forgery, &c. be alleged against any one that is to be ordained, either priest or deacon, the bishop ought to desist from ordaining him. The person to be ordained is to bring a testimonial of his life and doctrine to the bishop, and to give account of his faith in Latin; and both priests and deacons are obliged to subscribe the 39 articles.

The ordination of bishops is more properly and more commonly called *consecration.*

In the ancient discipline there was no such thing as a vague and absolute ordination; but every one was to have a church, whereof he was to be ordained clerk, or priest. In the twelfth century they grow more remiss, and ordained without any title or benefice.

The Council of Trent restored the ancient discipline, and appointed that none should be ordained but those who were provided of a benefice sufficient to subsist them. Which practice still obtains in England.

The council of Rome, in 944, ordered, that no ordinations shall be held, except on the first, fourth, seventh, and tenth months. In England, by can. 31. ordination days are the four Sundays immediately following the Ember-weeks; being the second Sunday in Lent, Trinity-Sunday, and the Sundays following the first Wednesday after September the 14th, and December the 13th. These are the stated times; but ordinations may take place at any other time, according to the discretion of the bishop or circumstances of the case.

Pope Alexander II. condemns *ordination per saltum,* as they call it; i. e. the leaping to a superior order without passing through the inferior.

Ordination is one of the sacraments of the church of Rome.

In the establishment of Scotland, where there are no bishops, the power of ordination is lodged in the presbytery, and by the Independents in the suffrage of the people. See Episcopacy, Presbyterians, and Independents.

ORDNANCE, a general name for all sorts of great guns used in war. See Gunnery.

Boring of Ordnance. Till within these 20 years, iron ordnance were cast with a cylindrical cavity, nearly of the dimension of the caliber of the piece, which was afterwards enlarged to the proper caliber by means of steel cutters fixed into the dog-head of a boring-bar-iron. Three side cutters equidistant were requisite to preserve the caliber straight and cylindrical; and a single cutter was used at the end of the bar to smooth the breech of the piece. In boring ordnance cast hollow, the piece was fixed upon a carriage that could be moved backwards and forwards in a direct line with the centre of a water-wheel; in this centre was fixed the boring-bar, of a sufficient length to reach up to the breech of the piece, or more properly to the further end of the caliber. The carriage with the piece being drawn backwards from the centre of the water-wheel to introduce the boring and finishing bars and cutters, it is then pressed forwards upon this bar by means of levers, weights, &c. and the water wheel being set a-going, the bar and cutters are turned round, and clean out and smooth the caliber to its proper dimensions.

Experience at last pointed out many inconveniences arising from the method of casting guns *hollow*, and widening the calibers by these boring bars. For the body of iron of the hollow-gun, being, at casting, in contact with the core that made the caliber within-side, and with the mould without-side, began to consolidate towards these sides in the first place, sooner than in the intermediate space, where of course the contraction of the iron takes place; by which means, all guns cast hollow become more or less spongy where they ought to have been most compact; and numberless cavities also were created round the cores, from stagnated air generated in them, which were too deep to be cut out by the boring.

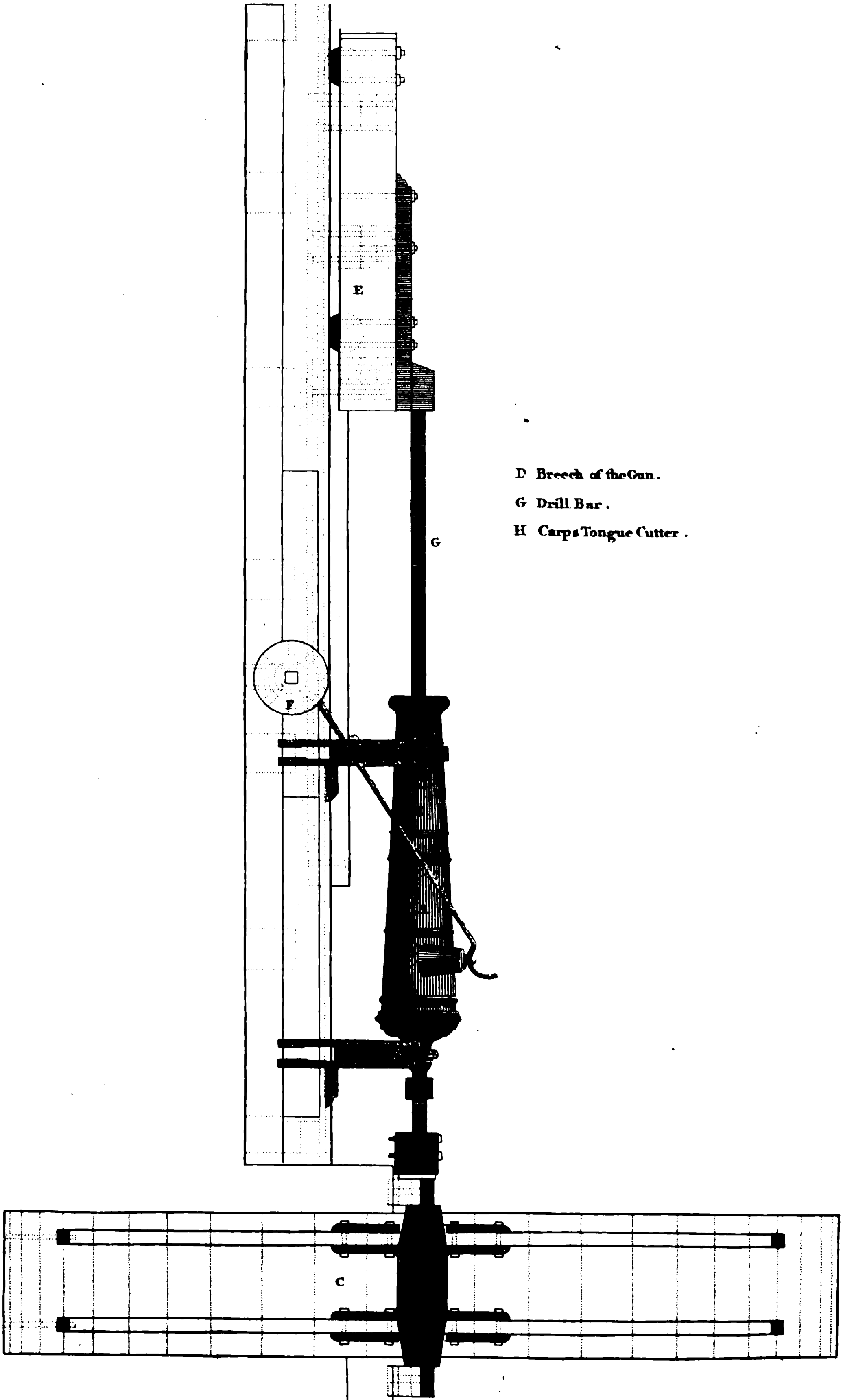
To remedy these defects, iron ordnance is now universally cast solid, by which means the column of iron is greatly enlarged, and the grain more compressed; and the contraction of the iron becomes in the heart of the column, and consequently is cut out by the perforation for the caliber.

Guns are bored out of the solid reversely from the hollow method. The piece A is placed upon two standards BB, by means of two journeys, turned round by the water wheel C, the breech D being introduced into the centre of the wheel, with the muzzle towards the sliding carriage E, which is pressed forwards by a ratch F, and weights, in the same way as the gun-carriage was in the hollow-boring. Upon this sliding carriage is fixed, truly horizontal and centrical to the gun, the drill bar G, to the end of which is fixed a carp's tongue drill or cutter H; which, being pressed forward upon the piece whilst it is turning round, perforates the bore, which is afterwards finished with borers and cutters as the hollow guns were. The principal difficulty of perforating solid guns truly centrical, arises from the contraction of the iron above mentioned; which, resisting the drill unequally, tends to throw it out of the centrical line.

Plate CCCXC.

Office of Ordnance, an office kept within the Tower of London, which superintends and disposes of all the arms, instruments, and utensils of war, both by sea and land, in all the magazines, garrisons, and forts, in Great Britain. We have the following copious account of this establishment in Beatson's *Political Index*. In ancient times, before the invention of guns, this office was supplied by officers under the following names: the *bowyer*, the *cross bowyer*, the *galeator* or *purveyor of helmets*, the *armourer*, and the *keeper of the tents;* and in this state it continued till Henry VIII. placed it under the management of a master, a lieutenant, surveyor, &c. &c.

Some improvements have been since made; and this very important branch is now under the direction of the master general of the ordnance, having under him a lieutenant general, a surveyor general, a clerk, a storekeeper, a clerk of the deliveries, and a treasurer, with a very great number of inferior officers, employed in



D Breech of the Gun.

G Drill Bar.

H Carps Tongue Cutter.

Engraved by W. & D. Lizars Edin.r

Ordnance. in the Tower of London, at Woolwich, and in almost all the forts, garrisons, and principal ports in his majesty's dominions. The office of ordnance is divided into two distinct branches, the civil and the military; the latter being subordinate, and under the authority of the former. For the better understanding the business of the different officers, they shall be distinctly treated of, beginning with the principal one, viz.

Master General of the ORDNANCE is deemed the principal officer in the civil branch of the ordnance; yet he is always chosen from amongst the first generals in his majesty's service. His trust is very great, as in him is vested the sole power of storing all the military magazines in the king's dominions with proper munitions of war, and likewise to supply the royal navy with what they may need in his department, the parliament granting money in the most liberal manner for this purpose. He is colonel in chief of the royal regiment of artillery, at present consisting of four battalions; and he is invested with a peculiar jurisdiction over all his majesty's engineers employed in the several fortifications in his majesty's dominions; and to him they are all accountable for their proceedings, and from him they receive their particular orders and instructions, according to the directions and commands given by his majesty in council. As master general of the ordnance he has the appointment of almost all the inferior officers and servants. He has a secretary, and an under-secretary; and besides there is a secretary and a counsel to the board of ordnance.

Lieutenant General of the ORDNANCE receives all orders and warrants signed by the master-general, and from the other principal officers, and sees them duly executed, issues orders as the occasions of the state require, and gives directions for discharging the artillery when required at coronations, birth days, signal victories, and other solemn occasions. It is also his peculiar office to see the train of artillery, and all its equipage, fitted for motion, when ordered to be drawn into the field, or sent upon any particular service. He is colonel *en second* of the royal regiment of artillery, and has a secretary and several inferior officers and clerks under him.

Surveyor General of the ORDNANCE inspects the stores and provisions of war in the custody of the storekeeper, and sees that they are ranged and placed in such order as is most proper for their preservation. He allows all bills of debt, and keeps a check upon all labourers and artificers work; sees that the stores received be good and serviceable, duly proved and marked, as they ought to be, with the king's mark, taking to his assistance the rest of the officers and proof-masters. To assist him in the business of his office, he has under him the proof-master of England, and clerks, and other inferiors officers.

Clerk of the ORDNANCE, an officer whose function is to record all orders and instructions given for the government of the office; all patents and grants; the names of all officers, clerks, artificers, gunners, labourers, &c. who enjoy those grants, or any other fee for the same; to draw all estimates for provisions and supplies to be made, and all letters, instructions, commissions, deputations, and contracts for his majesty's service; to make all bills of imprest and debentures, for the payment and satisfaction of work done and provisions received in the said office; and all quarter books for the salaries and allowances of all officers, clerks, &c. belonging to the office; and to keep journals and ledgers of the receipts and returns of his majesty's stores, to serve as a check between the two accountants of the office, the one for money, and the other for stores. Ordnance ‖ Ordovices.

Storekeeper of the ORDNANCE takes into his custody all his majesty's ordnance, munitions and stores belonging thereto, and indents and puts them in legal security, after they have been surveyed by the surveyor-general, any part of which he must not deliver without a warrant signed by the proper officers: nor must he receive back any stores formerly issued till they have been reviewed by the surveyor, and registered by the clerk of the ordnance in the book of remains; and he must take care that whatever is under his custody be kept safe, and in such readiness as to be fit for service upon the most peremptory demand.

Clerk of the Deliveries of the ORDNANCE draws all orders for delivery of any stores, and sees them duly executed; charges by indenture the particular receiver of the stores delivered; and, in order to discharge the store-keeper, registers the copies of all warrants for the deliveries, as well as the proportions delivered.

Treasurer and Paymaster of the ORDNANCE receives and pays all moneys, both salaries and debentures in and belonging to this office. In his office are several clerks, ordinary and extraordinary, for the dispatch of business.

Office of ORDNANCE. Besides the principal officers already mentioned, there belong to this office two proof-masters; a clerk of the works; a purveyor for the land, and a purveyor for the sea; an architect; an astronomical observer; and other officers. The other part of this office, which is termed the military branch of the ordnance, is a chief engineer, who has under him two directors, four sub-directors, with an unlimited number of engineers in ordinary, engineers extraordinary, sub-engineers, and practitioner engineers.

ORDNANCE *Bills*, commonly called *ordnance debentures*, are bills issued by the board of ordnance on the treasurer of that office, for the payment of stores, &c. These are not payable at any certain time, and do not bear any interest, so that the discount upon them is often very high; but they are seldom much above two years in arrears.

ORDONNANCE, in architecture, is the composition of a building, and the disposition of its parts, both with regard to the whole and to one another; or, as Mr Evelyn expresses it, determining the measure of what is assigned to the several apartments. Thus ordonnance is the judicious contrivance of the plan or mould; as when the court, hall, lodgings, &c. are neither too large nor too small, but the court affords convenient light to the apartments about it; the hall is of fit capacity to receive company; and the bed-chambers, &c. of a proper size. When those divisions are either too great or too small, with respect to the whole, as where there is a large court to a little house, or a small hall to a magnificent palace, the fault is in the ordonnance. See ARCHITECTURE.

ORDONNANCE, in *Painting*, is used for the disposition of the parts of a picture, either with regard to the whole piece, or to the several parts, as the groups, masses, contrasts, &c. See PAINTING.

ORDOVICES, ancient Britons, of whom we have the following account in Henry's History of Great Britain. They lived "in that country which is now called

North Wales, and contains the counties of Montgomery, Merioneth, Caernarvon, Denbigh, and Flint. These Ordovices, or (as they are called by Tacitus) Ordeuices, are supposed to have been originally of the same tribe or nation with the Huicii of Warwickshire, who were under some kind of subjection to the Cornavii; but the Huicii of North Wales, being a free and independent people, were called Ordh Huici, or the free Huici. When they were invaded by the Romans, they showed a spirit worthy of their name, and fought with great bravery in defence of their freedom and independency. Though they received a great defeat from the Roman general Ostorius, in conjunction with the Silures, they maintained the war for a considerable time, until they were finally subdued, with great slaughter, by the renowned Agricola. It was probably owing to the nature of the country, and to the vicinity of Diva, now Chester, where a whole legion was quartered, that the Romans had so few towns or stations in the territories of the Ordovices. Mediolanum, which is mentioned by Ptolemy, was the capital of the nation, and was probably situated at Maywood, in Montgomeryshire. It was a place of some consideration in the Roman times, but was afterwards quite demolished by Edwin, king of Northumberland. Besides this, the Romans had a few other towns in this country; as Segontium, now Caernarvon; Conovium, now Conway; and Varæ, now Bodvary, which are all mentioned in the eleventh journey of Antoninus. The country of the Ordovices was comprehended in the Roman province which was called *Britannia Secunda*."

ORE, a mineral body, partly or entirely composed of metallic substances, in the natural state in which it exists in the earth. Metallic substances are found, either native, that is, pure, and uncombined with other substances, or alloyed with other metals, or combined with oxygen, or sulphur, or with acids; and thus it appears, that metals exist in ores, in four different states. 1. In the metallic state, when they are either pure, or combined with each other, as in the state of alloy. 2. In the state of an oxide. 3. Combined with sulphur in the state of sulphuret. And, 4. with acids, forming salts. For the particular description of ores, see MINERALOGY; and for the mode of their distribution in the earth, see GEOLOGY.

But ores are rarely found exactly in the state of combination now mentioned. It seldom indeed happens, that they are not mixed with various earthy minerals. As all metals are extracted from ores, it is of great importance to be acquainted, in the first place, with the materials of which they are composed, as they are obtained from the earth, with the view of ascertaining the nature and proportions of the various ingredients which enter into the composition; and in the second place, to know the simplest and easiest processes by which the metals may be separated, for the purposes of economy and manufactures. Hence, in the treatment of ores, two objects are in view. The first is their analysis, which is the province of the chemical philosopher; and the second is their reduction in the large way, which is the business of the metallurgist. The most improved methods for accomplishing each of these objects, will be detailed in the following treatise.

ORES, Reduction and Analysis of.

In the treatment of metallic ores, it has been already hinted, that two objects are in view: the one is to obtain a knowledge of the nature and proportions of their component parts; and the other is to be acquainted with the best methods of separating the metals which they contain, that they may be applied in their pure or uncombined state to useful purposes. In the following treatise, therefore, we shall keep in view the same objects: and under each of the metals we shall first detail the most improved methods of analysing its different ores; and, secondly, give a short account of the best and most approved processes that are employed in their reduction. The last object, however, refers only to some of the metals, others not being found in sufficient quantity, or not being applicable to useful purposes.

In this treatise we shall consider the metals in the same order in which they have been described under MINERALOGY, and to each metal we shall devote a particular chapter.

Chap. I. *Of the Ores of Platina.*

PLATINA, on account of its infusibility, density, and indestructibility, is one of the most important and useful of the metals yet known, and particularly for different chemical instruments and utensils, because there are few chemical agents whose effects it cannot resist. Platina is only found in the state of alloy, with rhodium and palladium, two of the newly discovered metals; and it is accompanied also with another alloy, iridium and osmium, also newly discovered metals, as well as with particles of iron, gold and some other substances. The discovery of these metals, and the importance of platina itself, have rendered the ores of this metal peculiarly interesting. We shall therefore in the present chapter, give a pretty full detail of the methods of analysing the ore, and of working it for the purposes of manufacture. These subjects will occupy the two following sections.

Sect. I. *Of the Analysis of the Ores of Platina.*

The whole of the platina which is brought to Europe, has been previously subjected to the process of amalgamation in South America; and hence it happens, that a small quantity of mercury remains in it, sometimes in very small distinct particles, but more commonly in a state of combination with gold, in the form of an amalgam. In treating the ores of platina, therefore, the first object is to separate the mercury, and the easiest process is to drive it off by means of heat, either in an open ladle, if it be not intended to collect the mercury, or in an earthen retort, if the object of the operator be to retain that metal. The platina remaining after the mercury is thus driven off, appears much yellower, because the particles of gold dispersed through it exhibit their peculiar colour. The ore is next to be spread out thin on a smooth table, and by means of a pair of common bellows, the lighter particles may be separated with tolerable

Platina.

lerable accuracy from the heavier ones. The lighter particles in the ore are found, on examination, to be minute crystals and fragments of quartz, and two kinds of iron ore, which are also in fragments, or in the form of small octahedrons. Some of the particles of iron are attracted by the magnet, forming the ore of iron called *magnetic iron-sand;* but others, which are not attracted by the magnet, give out, when roasted, a slight sulphureous odour.

The lighter particles being separated by mechanical action, the heavier particles are to be treated with a small quantity of slightly diluted nitro-muriatic acid, and by this means the whole of the gold is taken up, with a portion of iron, and a small quantity of platina and other ingredients. The gold may be thrown down from this solution by adding green sulphate of iron, and it may be purified by mixing it with nitre and borax. If the quantity of platina to be purified be considerable, it is an object worth the attention of the chemist, to separate and collect the gold, because the proportion of the latter contained in crude platina is not small. Proust obtained seven ounces of gold from a quantity of platina consisting of 100 ounces; and from another quantity of the same weight he separated not less than 13 ounces of gold*. It may be observed that the platina which is whitest, is found to be the richest in gold, and that the black varieties scarcely contain any at all.

* Ann. de Chim. xxviii. 146.

The gold being separated, the platina is next to be digested in nitro-muriatic acid, and excepting a black matter, the whole is dissolved. This black matter, when first observed, was supposed to be plumbago; but it appears from the discovery of Mr Tennant, to be a compound of two new metals, to which he has given the names of osmium and iridium. By adding muriate of ammonia to the nitro-muriatic solution, almost the whole of the platina is precipitated in the form of a yellow powder. This powder is a muriate of ammonia and platina, and it is nearly insoluble. The solution being next treated with zinc, the whole of its metallic contents, excepting the iron, are thrown down. The precipitate thus obtained is to be washed and digested in nitric acid much diluted. By this means the copper and lead with which crude platina is usually contaminated, are separated. The remainder is to be dissolved in nitro-muriatic acid; to the latter sollution add common salt, and evaporate the whole to dryness; the salt remaining contains the muriates of soda and of platina, palladium and rhodium; and as the salt of rhodium is found to be insoluble in alcohol, it may, by means of it, be separated from the former. The platina and palladium now remain in the alcoholic solution, and from this the greater part of the platina may be separated by means of muriate of ammonia; and after diluting the solution by adding prussiate of potash, a deep orange precipitate is obtained, which is palladium. By concentrating the remaining liquor, the platina may be precipitated by means of muriate of ammonia.

Sect. II. *Of the Methods of working Platina.*

Platina, on account of its peculiar properties in resisting great degrees of heat and the action of many of the most powerful chemical agents, is by far the most important and valuable of the metals yet known for the purpose of constructing various instruments and utensils which are found highly useful in chemical analysis. But the refractory nature of this metal has presented many difficulties, and has greatly exercised the ingenuity and skill of chemists and artists to rendered it malleable and capable of assuming the requisite forms. It has been observed that the largest and whitest grains picked out from crude platina have a considerable degree of malleability even when cold; but when they are heated, this property appears in greater perfection: and if two of these grains be brought into contact, and subjected to the highest degree of white heat, the stroke of a hammer will make them adhere more or less perfectly. In this way, a small mass of metal may be obtained by the union of a few grains. But it is obvious that the patience and dexterity required in this slow and tedious process will prevent it from being practically useful.

In the progress of experiments made on platina it was discovered that arsenic combined readily with that metal, and formed an alloy of easy fusibility. The great volatility of the arsenic, particularly when in contact with charcoal, gave reason to hope that the whole of it, by proper management, might be driven off, leaving the platina behind in a mass, and retaining its peculiar and characteristic properties. In this way different chemists succeeded in forming, of this alloy, crucibles and other chemical utensils, which were found to be less fusible than silver, and were capable of resisting many of the common chemical agents. The most successful method of rendering platina malleable, and working it by means of this alloy, was discovered by Jeanety, a Parisian silversmith, who long directed his attention to this object. An account of his method has been given by Berthollet and Pelletier, of which the following is an abstract*.

* Ann. de Chim. xiv. 20.

The crude platina being first ground in water, and washed for the purpose of separating the earthy matters, three half pounds of the metal, three pounds of white arsenic, and one pound of pearl ashes, are to be well mixed together. A crucible, capable of holding 20 pounds of this mixture, is then to be placed in a furnace of any convenient construction. When the crucible is thoroughly red hot, introduce one-third of the mixture, and continue stirring it with a rod of platina till it comes to a state of quiet fusion; then add another one-third, stirring it in the same manner till the fusion is completed, and afterwards add the remaining one-third, and apply a strong heat, so that the whole may become very fluid. Then withdraw the crucible, and when it has cooled gradually, break it up; a well formed metallic button will be found in it, covered by blackish brown scoriæ, which has a considerable action on the magnetic needle. The button, which is very brittle, being broken to pieces, is to be fused again with white arsenic and pearl ashes as before, and the metallic mass obtained from this second fusion is generally found to have no effect on the magnetic needle; but if this should not be the case, a third fusion in the same way becomes necessary.

The first step of the process is now completed. A flat-bottomed cylindrical crucible, about three inches and a half in diameter, is to be made thoroughly hot in a furnace, and charged with one pound and a half of the arsenicated platina, mixed with an equal weight of white arsenic, and one half pound of pot-ash; and when this mixture

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mixture has been completely fluid, the crucible is to be removed from the fire, and allowed to cool in a horizontal position, that the thickness of the cake of metal may be uniform. When the crucible is cold, it is to be carefully broken, and the scoriæ being removed, a cake of metal is obtained, well-formed and sonorous, weighing three ounces more than the arsenicated platina employed. The metal is now quite saturated with arsenic. It has been observed, that there is no inconvenience from incorporating too much arsenic, for it would appear that the full success and rapidity of the purification of the platina, are exactly in proportion to the quantity of arsenic with which it has been previously combined.

The mass of metal thus obtained, is placed in a muffle, and the heat is gradually increased, till the evaporation of the arsenic commence; after which the temperature is to be kept up as nearly as possible at the same degree, for the space of six hours, carefully watching not to increase it, lest the cake should be brought to a state of fusion. At the end of the six hours, the cake has usually become considerably porous; it is then to be withdrawn, and extinguished in common oil; after which it is returned to the muffle, by which means a further quantity of arsenic is drawn off; and this alternate heating and application of oil are to be continued till the arsenic no longer makes its appearance. In proportion as the arsenic is driven off, the fusibility of the mass diminishes, so that a greater degree of heat may be applied in the latter stage of the process. After having carefully burnt off at a high degree of heat the whole of the charcoal which is produced by the decomposition of the oil, the spongy cake of metal is to be digested in nitrous acid, and then edulcorated by repeated boiling in water. Three or more of the cakes are then to be placed in a crucible, and exposed to the highest degree of heat in a powerful furnace, and while they are thus rendered soft, an iron pestle let down upon them, will make them cohere; and being withdrawn from the crucible, they are to be heated to the utmost in a smith's fire, and carefully forged like iron on the anvil, into compact bars.

The cheapness of the process now detailed is the only advantage which it holds out, for the platina does not require to be previously dissolved in nitromuriatic acid; but it is to be observed, that the metal by this treatment is by no means perfectly pure; a small portion of arsenic and iron still adhering to it, and probably some lead and copper, which may have been accidentally mixed with the ore, while it contains the whole of the palladium, osmium, iridium, and rhodium; and thus contaminated, it is obvious, that it must be less capable of resisting the action of alkalies, and high degrees of heat without injury, than when it is brought to a state of greater purity. Accordingly, other processes for the purification of this valuable metal, have been contrived and practised.

The following is the processes proposed by Count Moussin Poushskin, to render platina malleable. 1. Precipitate the platina from its solution by muriate of ammonia, and wash the precipitate with a little cold water.

2. "Reduce it in a convenient crucible to the well-known spongy metallic texture, which wash two or three times with boiling water to carry off any portion of saline matter which may have escaped the action of the fire.

3. Boil it for about half an hour in as much water, mixed with one-tenth part of muriatic acid, as will cover the mass to the depth of about half an inch, in a convenient glass vessel. This will carry off any quantity of iron that might still exist in the metal.

Platina.

4. "Decant the acid water, and edulcorate or strongly ignite the platina.

5. "To one part of this metal take two parts of mercury, and amalgamate in a glass or porphyry mortar. This amalgamation takes place very readily. The proper method of conducting it is to take about two drams of mercury to three drams of platina, and amalgamate them together; and to this amalgam may be added alternate small quantities of platina and mercury till the whole of the two metals are combined. Several pounds may be thus amalgamated in a few hours, and in the large way a proper mill might shorten the operation.

6. "After the amalgam is completely produced, it must be quickly moulded in bars or plates, or any other forms that may be preferred; taking care that these moulded pieces should at least be half an inch in thickness, and of a proper length to manage them afterwards in the fire; it is also requisite that the mould should be perfectly even and smooth. Half an hour after the pieces are formed they begin to harden by the oxidation of the mercury, and change their brilliant metallic colour for a dull learden ore.

7. "As soon as the pieces have acquired a proper degree of hardness to be handled without danger of breaking, which commonly takes place in a little more than an hour, place them in a proper furnace, and keep them ignited under a muffle or in a small reverberatory. No other precaution is necessary in this operation, but that of not breaking the pieces during their transport. The mercury flies off during the heat, and the platina remains perfectly solid; so that, after being strongly ignited two or three times before the bellows, it may be forged, or laminated in the same manner as gold or silver; care being taken, at the commencement of the forging, or of passing it between rollers, not to apply too great a force till the metal has acquired all its density. It is almost superfluous to add, that in evaporating the mercury from large quantities of amalgam, a proper apparatus, such as in the silver amalgamation, must be employed, to receive the volatilized mercury; but for small quantities, where the loss of this metal is of no consequence, the furnace must have a proper chimney to carry off the metallic vapours. When the platina comes out of the first fire, its dimensions are about two thirteenth parts smaller every way than the original amalgam from the mould. The whole of this operation seems to be governed by the pressure of the atmosphere and the laws of cohesive attraction: for the air is driven out from between the molecules of the platina, which by their solution in mercury are most probably in their primitive and consequently uniform figure. It is very visible, and at the same time a very amusing phenomenon to observe, (during the process of ignition, which is performed in four or five minutes), how the platina contracts every way into itself, as if pressed by some external force."

The count then adds, "that, as soon as my amalgam of mercury is made, I compress the same in tubes of wood, by the pressure of an iron screw upon a cylinder of wood, adapted to the bore of the tube. This forces out the superabundant mercury from the amalgam, and renders

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renders it solid. After two or three hours I burn upon the coals, or in a crucible lined with charcoal, the sheath in which the amalgam is contained, and urge the fire to a white heat; after which I take out the platina in a very solid state, fit to be forged *."

* Nichol. Journ. ix. 65.

A simpler method for rendering platina malleable, at the same time not less effectual, has been proposed by Mr Knight. The following is an account of this method in the words of the author.

"To a given quantity of crude platina, I add fifteen times its weight of nitro-muriatic acid (composed of equal parts of nitric and muriatic acid) in a tubulated glass retort, with a tubulated receiver adapted to it. It is then boiled, by means of an Argand's lamp, till the acid has assumed a deep saffron colour; it is then poured off; and if any platina remain undissolved, more acid is added, and it is again boiled until the whole is taken up. The liquor, being suffered to rest till quite clear, is again decanted: a solution of sal-ammoniac is then added, by little and little, till it no longer gives a cloudiness. By this means the platina is thrown down in the form of a lemon-coloured precipitate, which having subsided, the liquor is poured off, and the precipitate repeatedly washed with distilled water till it ceases to give an acid taste; (too much water is injurious, the precipitate being in a certain degree soluble in that liquid): the water is then poured off, and the precipitate evaporated to dryness.

"So far my process is in a great measure similar to that which some others have also followed; but my method of managing the subsequent, and which are indeed the principal manipulations, will be found to possess many advantages over any that has yet been made public. The best process hitherto followed has been, to give the precipitate a white heat in a crucible, which in some measure agglutinates the particles; and then to throw the mass into a red-hot mortar, or any similar implement, and endeavour to unite them by using a pestle or stamper. But the mass is so spongy that it is hardly possible to get a single stroke applied to it before the welding heat is gone; and though by peculiar dexterity and address some have in this way succeeded, it has been found to require such innumerable heatings and hammerings, that most of those who have attempted it, have either failed entirely, or given it up as being too laborious and expensive. I have succeeded in obviating all these difficulties by adopting the following simple, easy, and expeditious method:—

"A strong, hollow, inverted cone of crucible earth being procured, with a corresponding stopper to fit it, made of the same materials, the point of the latter is cut off about three-fourths from the base. The platina, now in the state of a light yellow powder, is pressed tight into the cone, and a cover being fixed slightly on, it is placed in an air furnace, and the fire raised gradually to a strong white heat. In the mean time the conical stopper, fixed in a pair of iron tongs suitable for the purpose, is brought to a red or to a bright red heat. The cover being then removed from the cone, the tongs with the heated stopper is introduced through a hole in the cover of the furnace, and pressed at first gently on the platina, at this time in a state nearly as soft as dough, till it at length acquires a more solid consistence. It is then repeatedly struck with the stopper, as hard as the nature of the materials will admit, till it appears to receive no farther impression. The cone is then removed from the furnace, and being struck lightly with a hammer, the platina falls out in a metallic button, from which state it may be drawn, by repeatedly heating and gently hammering, into a bar fit for flatting, drawing into wire, planishing, &c.

"Besides the comparative facility of this process, it has the farther advantage of rendering the platina much purer than when red-hot iron is obliged to be had recourse to; for platina, when of a white heat, has a strong affinity for iron, and, with whatever care it may have been previously separated from that metal, will be found to have taken up a portion of it, when it is employed of a red heat, to serve to unite the particles of the platina. To the superior purity of platina, rendered malleable by the process before described, I attribute the greater specific gravity which I find it to possess, than that prepared by other methods. Having taken the specific gravity of about ten pennyweights of it, which I had previously passed repeatedly through a flatting mill, I found it to be 22.26†."

† Phil. Mag. vi. 2.

Another method, which has been successfully practised, was contrived by Mr Cock. The following is an account of his process. After the solution of the platina in nitro-muriatic acid, the liquor is filtered through clean sand, for the purpose of separating the black powder which floats in it. The clear solution is then decomposed by means of sal ammoniac; the yellow precipitate being collected, is to be moderately well washed in warm water and dried; and being distributed into saucers placed in a small oven, constructed for the purpose, in which they are to be exposed for a short time to a low red heat, that the platina may be brought to the metallic state, and the greater part of the sal ammoniac may be sublimed. When the platina, after this treatment, is withdrawn, it is in the form of a gray coloured, spongy mass; and in this state half an ounce of it is to be put into a strong iron mould, one inch and a half wide, and two and a half long. It is then to be compressed as strongly as possible, by striking with a mallet upon a wooden pestle accurately cut to fit the mould; another half ounce is then added, and treated in the same manner, till six ounces have been forced into the mould; a loose iron cover, just capable of sliding down the mould, is then laid upon the platina. This part of the process requires particular care; for if any material quantity of air be left in the mass, the bar into which it is formed is extremely apt to scale and be full of flaws in the subsequent operations. The pressure being properly made, the mould is to be taken to pieces, and the platina will be found in the form of a dense compact parallelopiped. It is next to be placed in a forge fire of charcoal, and heated to the most intense white heat, in order to drive off the muriate of ammonia which remains: this being done, it is to be quickly placed on a clear bright anvil, and gently hammered in every direction by a clean hammer. This is several times to be repeated, at the end of which the mass will be perfectly compact, and fit to be laminated or wrought in any other manner at the pleasure of the artist. It is to be observed, that while the platina is heating, it must be loose in the fire, for if it were held by the tongs, they would infallibly become welded to the platina, and by this means greatly damage it. When the platina is thus drawn down to a compact bar, it will be covered by a semivitreous crust,

somewhat

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somewhat reddish, chiefly proceeding from particles of the ashes melted down upon it, and extended by the hammer over its surface. To remove this, the bar, after being made red hot, is to be sprinkled over with glass of borax reduced to powder, and then kept at a white heat for a few minutes; it is to be plunged into diluted muriatic acid when moderately cool, by which the borax and other vitreous matters will be dissolved, and the platina with a perfectly clean white surface left behind *.

* *Aikin's Diction. of Chem.* &c. ii, 433.

Chap. II. *Of the Ores of Gold.*

Gold exists in nature only in the metallic state; but it is scarcely ever found perfectly pure, for it is alloyed in different proportions with silver, copper, tellurium, and some other metals. When it is alloyed with silver or copper, or even with both, the gold retains its ductility; but when combined with tellurium, its distinctive characters entirely disappear.

Sect. I. *Of the Analysis of the Ores of Gold.*

The method of analysing gold ores is very simple. The principal difficulty with which it is attended arises from the small proportion of this metal contained in the greater part, even of those ores which are considered as very rich. Native gold contains invariably, but generally in small proportion, silver or copper, and sometimes both, and the gangue is often a very hard quartz. In this case the following is an approved mode of proceeding. Reduce the ore to fine powder, mix it with six times its weight of carbonate of soda, or, what answers better, with four parts of carbonate of soda, and one of glass of borax: put the mixture into an earthen crucible, and melt it. Pour out the fused mass on a stone slab, and detach the small portion remaining in the crucible by means of a little diluted muriatic acid. Reduce the mass to coarse powder; put it into a flask with the muriatic solution; add strong muriatic acid, and apply a gentle heat. Continue the digestion, adding from time to time a little nitrous acid, till no farther action is produced, and the undissolved residue becomes of a pure white colour. Then pour off the liquor, wash the residue, and add the washings to the liquor.

1. After the insoluble residue is dried, expose it to the sun, and if it contain any muriate of silver, it will assume a purplish colour. When this is the case, let it be mixed with three times its weight of pearl-ash, and fused in an earthen crucible for five minutes. The silver will thus be reduced to metallic globules, and will be obtained pure by digesting it in muriatic acid, which combines with the earth and alkali, but does not act on the silver.

2. The nitro-muriatic solution is now to be carefully neutralized by means of soda or of potash; and a solution of green sulphate of iron is to be added, as long as any precipitate is formed. The precipitate thus obtained is gold, and this being carefully collected, is to be fused in a small crucible with nitre just in sufficient quantity to cover its surface.

3. The residual liquor, after being decomposed by the carbonate of an alkali, and the precipitate being well washed, is to be digested in liquid ammonia, to dissolve the copper. The ammoniacal solution being slightly supersaturated with muriatic acid, a rod of zinc being introduced, will precipitate the copper in the metallic state.

Auriferous pyrites. It appears that iron pyrites of a bronze yellow colour in masses, or in striated cubes, and hepatic pyrites, which are found in veins in primitive mountains, contain a quantity of pure gold, or of gold alloyed with silver, which is worth the trouble and expence of extracting it. A considerable proportion, not only of the American, but also of the Hungarian gold, is obtained from ore of this kind. The produce of the latter sometimes does not exceed a few grains of gold in the quintal, but occasionally the auriferous pyrites of the Hungarian mines yield not less than 450 ounces of gold in the quintal of the ore.

The following is the method of analysis to be followed in ores of this kind. The pyrites being reduced to powder, is digested in muriatic acid, occasionally adding a small portion of nitric acid, till every thing soluble is taken up. The residue, after being well washed and dried, is to be weighed, and exposed to a heat which is just sufficient to burn off the sulphur, the quantity of which is indicated by the loss of weight. The residue is again to be digested in nitro-muriatic acid, and this solution is to be added to the first. The earthy residue, which contains the silver in the state of muriate, is then to be fused with an equal weight of glass of borax, and three times the quantity of pearl ashes. By this process the silver is reduced, and may be separated from the alkali and the earth by means of muriatic acid very much diluted. The nitro-muriatic solution is to be neutralized by a fixed alkali, and if it be afterwards treated with nitrate of mercury prepared in the cold, the gold will be thrown down in the state of a brown powder. It may be reduced to the metallic state by fusing it with nitre. The oxide of iron which remains in solution, may be obtained in the usual way in the state of magnetic oxide.

Auriferous galena.—Galena, or the native sulphuret of lead, almost always contains a small portion of silver, and very often it is in such quantity as to be worth the trouble of extracting it. Galena sometimes has also combined with it a little gold as well as silver, and it is worked as one of the ores of gold. This is the case with some of the galena of Hungary, as that of Boicza yields $1\frac{1}{2}$oz. of alloy in the quintal, of which 31 parts are silver, and one of gold.

The analysis of auriferous galena is to be conducted nearly in the same way as the auriferous pyrites. The pulverised ore being digested in nitro-muriatic acid, the gold and the lead, and, if any are present, the iron and antimony, are taken up; leaving behind the earthy matters, as well as the sulphur and silver, which may be separated according to the method employed in the former process. By gradually evaporating the nitro-muriatic solution, a crystallized muriate of lead is obtained; and by again diluting the solution with water, the gold may be separated by adding nitrate of mercury.

The analysis of the ores of gold containing tellurium, will be given under the head of that metal.

Sect. II. *Reduction of the Ores of Gold.*

Many of the most profitable veins of gold are of trifling magnitude, but at the same time yield ample returns to the miner, although they are mixed with so large

Gold. large a proportion of stony matter and other impurities as would render the working of any other metal altogether unprofitable. This obviously arises from the great commercial importance of gold compared with other metals, which no doubt is owing as well to its rarity as to its peculiar properties. In the Hungarian gold mines, which are the richest yet known in the old continent, the attention of the miner is not merely limited to the strings of ore, but to the whole contents of the vein, which are usually extracted and raised to the surface in large masses. These masses are distributed to the workmen, who break them down, first with large hammers, and afterwards with smaller ones, till they are reduced to pieces of the size of a walnut. In the course of this process, every piece is carefully examined, and arranged according to its value. The smallest visible grain of native gold is separated from the quartz in which it is chiefly imbedded, and put by itself. The auriferous pyrites and galena are also put into separate heaps; even the small splinters that are detached in breaking down the masses, and the sand and mud of the mine, are all collected, washed, and sifted, and ranged according to their apparent richness. What has been rejected in the first examination, is re-examined by boys, whose labour is not of great value, and who pick out almost the whole that has been overlooked by the men, and arrange it in the same manner.

The native gold with the matrix attached to it, is again to be broken by hand into still smaller pieces, by which means other impurities and stony matters are separated. The ore is then introduced into a wooden box floored with cast-iron plates; and by the action of two or more heavy spars of oak, which are shod with iron, and alternately worked like the common stamping mill, it is reduced to a fine powder. This powder, which is called flour, is then removed into a vessel like a large bason, and is mixed with such a quantity of salt and water as will render it damp. The workman then takes a thin porous leather bag, introduces a quantity of mercury into it, and by a regular and continued pressure forces the mercury in very minute drops through the leather. In this divided state it falls upon the pulverized ore, and is immediately kneaded up with it, till the requisite quantity, which depends on the proportion of gold, has been added. After completing this part of the process, the next object is to incorporate the mercury and the gold. This is effected by rubbing the mixture together for some time by means of a wooden pestle. The mixture is then heated in a proper vessel, and subjected for three or four days, to the temperature of boiling water; and, lastly, the mixture is to be carefully washed by small parcels at a time, so that the earthy particles may be carried off by the water. The mercury combined with the gold, only remains behind, in the form of amalgam. A portion of this mercury is then separated by pressure in a leathern bag, and the remainder is driven off by distillation, leaving behind the gold, and silver with which it may be alloyed.

But a more complicated process is requisite in separating that portion of the gold which is invisibly dispersed in the pyrites, in galena, and other metallic substances, as well as the stony parts of the matrix. In the treatment and sorting already described, those ores are separated, not only according to their apparent richness, but they are arranged also according to the degrees of hardness. They are then carried to the stamping mill, of which the principal parts are, 1. The coffers or cisterns, in which the ore is reduced to powder, and through which a stream of water continually passes, and so managed as to be increased or diminished at pleasure: 2. The stampers, or vertical beams, which are shod with iron; and, 3. The axle, which is fixed horizontally, and one end of which works in a pivot, while the other is rivetted into the centre of a large water wheel. The mode of action of this apparatus is obvious. A stream of water falls upon the wheel, and turns it round, as well as the axle to which it is attached. The cogs, which are fastened to the axle, alternately raise the stampers to a given height, and then let them fall upon the ore placed in the coffers. And as the ore is sufficiently broken, it is carried by the stream of water continually passing through, out at the sides of the coffer into the labyrinths, where the stony and metallic contents of the ore are deposited, according to their specific gravity, nearer to or at a greater distance from the aperture. The coffer is a rectangular hole sunk below the level of the ground, and it is about five feet in length, two feet and sometimes less in width, and four feet deep. Five stampers are employed: they are strong oaken beams shod with iron, and weighing about 200 pounds each. They are placed side by side, at the distance of about $2\frac{1}{2}$ inches from each other.

When the ore is to be pounded, the first thing is to cover the bottom of the coffer with a flooring or pavement, composed of large pieces of the hardest and poorest part of the vein. These pieces are to be close set together, and a floor of this kind is found to answer better than an iron floor. The thickness of the floor is to be proportioned according to the degree of hardness of the ore to be pounded; for it is obvious that the higher it is, the smaller will be the space through which the stampers fall; and their momentum will therefore be proportionably diminished. One precaution must be invariably observed, that the part of the floor immediately under the middle stamper be about two inches lower than that below the stamper on each side, and that this again be an inch lower than that beneath the two outermost stampers.

After the coffer is thus prepared, the machinery is set in motion, a small stream of water being allowed to flow into the coffer. The ore is to be carefully thrown in, just below the middle stamper, or the proper quantity is supplied by means of a hopper. The ore being thus broken down by the middle stamper, is gradually delivered to the stampers on each side, where it is still farther reduced to powder, and from them it passes on to the two outermost stampers, where it is reduced to such a degree of fineness as to be for a time suspended in the water, and carried along with the stream through the openings at the ends of the coffer.

In stamping the ores of gold and silver, great attention is necessary, that no pieces of ore be subjected to the process that can be conveniently separated from the gangue by the hand; and that the ore be reduced to a coarse or fine powder, according to its nature. When native gold is dispersed in minute particles, in a hard siliceous matrix, it is found impossible to separate the whole of the metal, unless it be very finely pulverized; and in this case the ore may be reduced to fine powder, both on account of the great difference of the specific gravity of the two ingredients of the ore, and also because the siliceous particles, however minute, acquire no degree of tenacity, so as to adhere to the particles of gold. In stamping

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stamping ores of this kind, therefore, the coffers may be set very low, that the stampers may have the greater power, and a small stream of water only may be let in, that the current which passes out may carry with it only the smaller particles. But when the gold is dispersed in an indurated and ochrey clay, or in calcareous spar; if the ore in this case be not finely pulverized, a great proportion of the metal will be retained in the earthy matrix; and if the stamping be continued too long, the whole will be brought to a fluid mud, which will prevent the subsidence of the particles of gold. In the management of this part of the process, no small degree of skill and experience is requisite, to obtain the greatest produce of gold.

The reduction of the ore to grains of a uniform size, greatly facilitates the washing which follows the stamping, and yields a greater product of metal. This is effected by taking care that the ore, when first introduced into the coffer, shall fall under the middle stamper, and also by the velocity of the water wheel being properly regulated. When the motion of the stampers is too slow, loss of time is the only consequence; but when the motion is greatly accelerated, the water is violently thrown about, carrying with it to the apertures at the end of the coffer, pieces of the ore that are not sufficiently comminuted.

The ore being reduced to particles of a sufficient degree of fineness to be carried by the force of the water out of the coffer, passes into shallow channels of different dimensions. These channels or troughs, the whole series of which is called a labyrinth, are constructed of wood or stone, and communicate with each other at the extremities. The various parts of the ore are deposited in these channels, according to their specific gravities; the heaviest particles are detained in the first, and the lightest are carried along, and subside in the last and lowest. Each of the channels has a groove at its lowest extremity, and thus admits of being closed at pleasure by pieces of wood about an inch in height, which slide down upon each other. By varying the rapidity of the current through the channels, the heavy particles can be more accurately separated from the lighter ones, which is done by diminishing the slope, and increasing the width and length of the channels.

But with whatever care the first operation of the washing may be conducted, it is by no means sufficient to separate the whole of the sand from the ore. A second washing on tables, as they are called, is requisite. These tables are long wooden planes, which are considerably inclined, and are crossed at regular distances by narrow shallow grooves. A long wicker basket, or perforated wooden trough, filled with the washed ore, is fixed to the upper extremity of the table, and a small stream of water is admitted, which passing between the twigs of the basket, carries with it particles of the ore. These particles are either carried by the current off the table, or are deposited, according to their specific gravity, in the grooves, the heaviest particles subsiding first. In this way the auriferous ores of iron and copper pyrites, galena, &c. are sufficiently separated from the quartz and other stony matter, to be fit for the furnace; but for the ores of native gold, a third washing is necessary. This is performed in small quantities at a time, in a wooden vessel resembling in shape a common fire-shovel without a handle, but having the sides more elevated, and being furnished with two ears, by which it is held during the operation. The ore is put into this vessel, which is gently immersed in water, and a circular motion is communicated to it by a peculiar dexterity, which can only be acquired by practice. By this motion in the water the lighter particles are gradually thrown out of the vessel, and scarcely any thing remains behind but the gold, which is either amalgamated or fused with the addition of a little nitre, in an earthen crucible. Here it may be added, that the separation of the gold which is found in alluvial soil, or in the sands of rivers, is conducted precisely in the same way, only that it is not necessary to be subjected to the process of stamping previous to washing.

The produce of the proper auriferous ores is seldom of sufficient value to admit of the same attention in washing as native gold; and therefore it is always found, after this operation, mixed with a considerable proportion of earthy matters. When the metallic part is composed of pyrites, which is frequently the case, it may be useful, previous to the fusion of the ore, to give it a moderate roasting, for the purpose of expelling the greater part of the sulphur; but it must be observed, that this process is to be regulated by the quantity, and refractory nature of the stony part of the ore; because the sulphur in the subsequent fusion acts the part of a flux, and therefore the cleaner the ore, the more perfectly it may be roasted. This part of the process being completed, a little quicklime, as a flux, is added, and carefully mixed with the ore, and a portion of galena, according to the proportion of gold and silver contained in the pyrites, previously discovered by assaying it. This mixture is next to be introduced into a reverberatory furnace, which is to be raised to a red heat; and when the mixture begins to clot together, it is to be stirred from time to time, and kept at a temperature inferior to that of fusion, till part of the sulphur is expelled; and when this is accomplished, the fire is to be increased, so that the whole may be brought to a state of thin fusion, after which it is let out in the usual way, and received in a mould of sand. During the process of fusion, the iron having a very strong affinity for sulphur, recombines with that portion of which it had been deprived by the roasting, in consequence of the decomposition of the sulphurets of lead and copper with which it is mixed; and these metals, by their specific gravity, fall in drops through the vitreous ferruginous scoriæ, and carry with them the gold and silver, with which they unite at the bottom into a dense mass of metal. Thus it happens that the pig formed in the mould consists of two parts, which adhere to each other, but may be easily separated by the hammer. The superior and the larger portion, is a cellular mass of scoriæ, and the lower is a black, heavy, compact mass, containing the gold and silver, along with lead, copper, and a portion of sulphur and iron. It is again broken into pieces, and roasted and fused once or twice, till the whole of the sulphur and other impurities are separated, and nothing remains but the metallic substances.

In the farther treatment of the ores of gold, the object of the refiner is to separate it from the metallic substances with which it is alloyed. We shall now mention the different methods which are followed in separating the metals from gold with which it is usually alloyed.

1. *Separation*

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1. *Separation of gold from platina.*—As platina, like gold itself, is not susceptible of oxidation by exposure to heat and air, it cannot be separated by the process of cupellation; and platina having as little affinity for sulphur as gold itself, that substance, or the sulphurated metals, cannot be successfully employed for this purpose. It has been found that mercury combines more readily with gold than with platina, and from the knowledge of this circumstance a method has been devised of separating these metals. When the proportion of platina is so large, that the mass is brittle, it must be reduced to powder in a mortar; but if it be ductile, it may be reduced to small pieces by granulation. A quantity of mercury equal to seven or eight times the weight of the alloy, is then to be heated in an iron crucible, and raised to the boiling point. The alloy being first made red hot, is to be dropt in, and the whole kept for half an hour nearly at the same temperature. The mixture is then emptied into an iron mortar, and being covered with hot water, is to be carefully triturated for some hours, the water being renewed from time to time. In this way the gold combines with the mercury, and a considerable proportion of the platina will rise to the surface of the amalgam in the state of a black powder, which may be easily scraped off. In this way the alloy is to be purified as much as possible, and the superfluous mercury may be separated by straining through leather, and the amalgam is deprived of the remaining mercury by the process of distillation. The gold, which still holds a small quantity of platina, is now to be melted with three times its weight of silver; and the mixture being granulated, is to be parted by means of nitrous acid. It has been found (although it be a singular circumstance) that pure platina, or even when mixed with gold, is perfectly insoluble in this acid; but, when combined with a large proportion of silver, it is readily dissolved, and the solution is of a dark yellowish brown colour; and, therefore, by digesting this triple alloy of gold, platina, and silver, in nitrous acid, the silver and platina are dissolved, and the gold remains behind. But it may be necessary to ascertain whether the whole of the platina be separated. This is done by melting a few grains of the gold, after careful washing, with three times their weight of silver, and treating it as before with nitrous acid. If it contain one half per cent. or even a smaller proportion of platina, the acid will be perceptibly coloured, and this being the case, the process must be repeated again on the whole mass. But this is rarely necessary when the previous trituration with mercury has been carefully performed. By adding to the remaining nitrous solution, a solution of common salt, the silver will be precipitated, leaving the platina in the solution.

By the following method, which is still more compendious, gold may be separated from platina. The alloy is dissolved in nitro-muriatic acid, and the gold is precipitated by means of carbonate of soda, or a large quantity of green sulphate of iron, neither of which has the effect of decomposing the solution of platina. The precipitated gold being dried, and mixed with a little borax and nitre, is subjected to fusion, after which it will be found in a state of perfect purity.

2. *Separation of gold from silver.*—In ores in which the proportion of gold is small, the silver may be conveniently separated by means of sulphur. The alloy is first melted, and granulated, by pouring it into cold water, which is kept in constant agitation with a rod or wicker brush. From an eighth to a fifth of the granulated metal is reserved, and the remainder is carefully mixed with about one-eighth of its weight of powdered sulphur, which adheres readily to the moist grains. The mixture is introduced into a covered crucible, and kept for some time at a gentle heat, that the metal may be completely penetrated by the sulphur, after which the heat is increased till the whole mass is brought into fusion. This sulphuret of silver becomes a tough viscous fluid, which retains the particles of gold, and prevents them from subsiding. The mass being kept in fusion for about an hour, that the union of the sulphur and silver may be completed, and any excess may be burnt off, a third part of the reserved silver in grains is to be added, and when it is melted, is to be stirred with a wooden rod, that it may be accurately mixed with the other materials, and brought into contact with the gold, with which it immediately enters into combination. The fusion being continued another hour, a similar quantity of grained silver is to be added, and after a third hour has elapsed, the remaining third is introduced, and treated in the same manner. The crucible, which is now to be kept carefully covered, is to be exposed to a high temperature for three hours, while the melted mass is stirred from the bottom every half hour. At the end of this time the surface of the mass, instead of being dark brown, becomes whitish as the sulphur escapes, and some bright white drops of melted silver, about the size of pease, make their appearance. The fused mass is now to be poured into a greased cone; and when it is cold, it will be found to be composed of a mass of sulphuret of silver, resting upon a white metallic button, which is nearly equal in weight to the added silver, and contains the whole of the gold that originally existed in the entire mass. If it appears that any of the gold remains among the sulphuret of silver, it may be separated by fusion in an open crucible. By this process part of the sulphur is burnt off, and a corresponding quantity of silver is reduced to the metallic state, which being carefully mixed with the remainder, and repeatedly stirred with a piece of stick, the whole of the gold remaining in the silver, which is still sulphurated, will be attracted; and by being poured into a cone, will be collected at the bottom in a mass.

The silver containing the gold, which is collected in these two operations, being melted and granulated, is subjected to one or more repetitions of the same process, till the silver that remains is found to contain a sufficient proportion of gold, to render it worth while to proceed to the process of parting by means of aquafortis. The whole of the silver may be separated by means of sulphur; but when the proportion of gold is considerable, the sulphuret of silver always takes up a part of it, which cannot again be entirely separated without repeated fusions; and therefore, when the gold is equal to $\frac{1}{30}$th of the silver, a further purification by means of sulphur, will scarcely be found advantageous.

An ingenious and economical method of separating the gold from old gilt silver lace or wire, has been extensively practised in Saxony. This method proceeds on the principle, that the affinity of gold for copper, and of silver for lead, is much greater than the affinity which subsists between gold and silver; and it is conducted

Gold. ducted in the following manner. The alloyed metal is first granulated, and $\frac{1}{16}$ of it is mixed with $\frac{1}{8}$ its weight of litharge, and $\frac{1}{8}$ of sandiver. This is called the precipitating mixture. The next is mixed with $\frac{1}{8}$ of powdered sulphur, and is brought into fusion, which being complete, as will appear from the flashing at the surface, $\frac{1}{4}$ of the precipitating mixture is added at three different times, allowing an interval of five minutes between each time; and the fusion is then continued for ten minutes longer. Part of the sulphurated silver is taken out with a small crucible made red hot, and the remainder being poured into the melting cone, a quantity of metallic silver combined with the greatest part of the gold, subsides to the bottom. The sulphuret of silver is again melted, and the remaining part of the precipitating mixture is added as at first, and thus a second portion of gold alloyed with silver is obtained. But as the sulphuret still retains a small portion of gold, it is to be fused a third time; and a precipitating mixture, equal in weight to the former, but consisting of an alloy of equal parts of copper and lead, is to be added, and thus a third precipitate of gold holding silver is obtained, and the sulphuret is now deprived of the whole of its gold.

The different metallic masses thus obtained, are melted with $\frac{1}{8}$ of lead, then granulated, and treated in the same way as at first, with sulphur and the precipitating mixtures. The silver thus obtained being rich in gold, is first to be granulated, then mixed with $\frac{1}{16}$ of sulphur, and kept in fusion for about half an hour without any addition; and being poured into a cone, the sulphuret is separated from the metal, and this last is treated two or three times more with sulphur, in a similar manner. The metallic button obtained, which now appears of a yellow colour, is to be melted with one sixteenth of copper, then granulated, and mixed with one sixteenth of sulphur; and the mixture being first gently heated in a covered crucible, and kept in fusion for about a quarter of an hour, is poured into a cone, at the bottom of which the gold is collected of a brass colour, and about eighteen carats fine. The purification is afterwards completed by means of sulphuret of antimony, a process which will be afterwards described.

3. *Parting operation.*—When the proportion of the gold and silver, alloyed together, is such, that the former is not much less than one sixteenth, or greater than one fourth of the whole mass, the operation of *parting* may be followed. In this method the gold is separated from the silver by means of diluted nitric acid, or, as it is termed by manufacturers, *aquafortis*, which dissolves the silver, and leaves the gold untouched. The button of gold and silver is prepared for this process by flattening with the hammer, again heating it red hot, and slowly cooling to anneal it for the purpose of increasing its malleability. It is then to be extended into a small plate as thin as a wafer, by passing it between rollers of polished steel, again heated, but only to redness, and last of all rolled up in the form of a small loose coil or spiral, called a cornet. The annealing is useful in allowing the metal to be rolled up without cracking, and at the same time the freer action of the acid, in consequence of the texture of the metal being somewhat opened.

The cornet thus prepared is introduced into a pear-formed matrass, called a *parting-glass*, and three or four times its weight of pure nitric acid of 1.25 specific gravity are added; the mouth being slightly covered to keep out the dust, the glass is set on a sand bath, or over charcoal, to boil. As soon as it becomes warm, the acid begins to act on the silver, and dissolves it with the evolution of nitrous fumes. During the whole action of the acid, the cornet appears all over studded with minute bubbles, and when these discontinue, or run into one another, forming a few large ones, the action of the acid is nearly over. The process is usually completed in about fifteen or twenty minutes from the time that the acid begins to boil. The cornet now appears corroded throughout, and has lost during the solution the whole of the silver; and the remaining gold which is slender and brittle, retains the same spiral form. Indeed it is of considerable importance that it should not be broken, for much of the accuracy of the operation depends on having the gold in one piece and not in fragments.

The acid solution of silver, while yet hot, is next to be carefully poured off, and a portion of fresh acid, somewhat stronger, is to be added, to separate all the remains of silver; the boiling is to be repeated as before, but only for five or six minutes; it is then poured off and added to the former solution, and the parting-glass is filled with hot distilled water, to wash off the remains of the solution. The cornet, which is now of a brown colour and spongy texture, and has little of the metallic appearance, is taken out in the following manner. A small crucible is inverted over the mouth of the parting-glass, while it is yet filled with the distilled water, and the latter being rapidly inverted upon the crucible, the cornet falls softly through the water down the neck of the glass into the crucible, where it is deposited, and the water is carefully poured off. The crucible after being dried is next heated to redness under a muffle. The cornet contracts greatly in all directions, becomes of a firm texture, and resumes its metallic lustre; and after being brought to a red heat and cooled, it exhibits the appearance of a cornet of pure gold, having all the splendour, softness, and flexibility of this precious metal. By accurate weighing, the amount of the product is precisely ascertained, and thus the operation of parting is completed.

But if the proportion of gold amount to one third of the mass, it combines with part of the silver, and protects the latter by its insolubility from being acted on by the acid, so that in the process of parting, too great a proportion of gold in the alloy must be avoided; and farther, as the acid is expensive, unless the silver be rich in gold, this process, which is in many respects convenient, will not be found economical. In reducing the fineness of the alloy which is too rich in gold to be advantageously parted by itself, it will be the object of the refiner not to employ pure silver, but such as contains a small portion of gold; and at the same time it will be his study to save the quantity of acid.

The following is the usual method of conducting the process of parting. After selecting a proper quantity of rich and poor ingots of mixed metal, the whole is to be fused in an iron crucible; and being well mixed by frequent stirring, it is to be removed by a clean iron ladle, and granulated in cold water. The parting-glasses, which are nearly of the form of a truncated cone with a rounded bottom, are about twelve inches high and seven inches wide at the lower extremity, and they should be of equal thickness, well annealed, and free from any kind of flaws. About forty ounces of metal are introduced into each glass, and the nitrous acid, half saturated

ted with silver, is added till it stand two or three fingers breadth above the surface of the metal. Twenty or even more of these glasses are placed in a sand bath, and the heat, which should at first be moderate, is gradually increased till it nearly reach the boiling point about the time that the acid is saturated. The nitrate of silver is poured off, a new portion of stronger acid is added, and boiled as before till it is nearly saturated, when almost the whole of the silver is taken up, and what remains undissolved has the appearance of a brown mud, and consists of the gold finely divided with a small portion of silver. The acid again saturated is poured off, and a third portion of still stronger acid is added, which is kept at the boiling temperature till the evolution of nitrous gass ceases, and the bubbles are enlarged, which shews that all the silver is taken up. The acid is then decanted off, and reserved for the first part of a future process of the same kind; and the gold is repeatedly washed with fresh portions of hot water till the washings dropped on a polished copper plate produce no stain; and the powder, being dried and mixed with little nitre and borax, is fused, and is then in a state of purity.

To decompose the nitrate of silver with the view of procuring the pure metal, the solution is poured into a wooden vessel lined with copper, and in which are placed plates of copper that the silver may be precipitated from its solution in consequence of the greater affinity of the nitrous acid for the copper. The surface of the plates is to be cleared from time to time of the silver crust, that a fresh surface of copper may be exposed to the action of the acid, and the decomposition of the nitrate of silver may be promoted; after which the nitrate of copper formed in the solution is decanted off, the plates are scraped, and the silver being washed is fused with nitre, and is also obtained in a state of purity.

4. *Separation of gold from silver or other metals by sulphuret of antimony.*—All the common metals, excepting zinc, which come under the denomination of imperfect metals, may be separated from gold by this process; for as gold is incapable of combining with sulphur, and as the affinity of almost all the other metals for sulphur is stronger than that of antimony, it is sufficiently obvious, that an alloy of gold with any of these metals, as for instance gold and copper, being added to sulphuret of antimony, the sulphur will combine with the copper, and the antimony will form an alloy with the gold. When common crucibles are employed for this process, some previous preparation is necessary. A well burned crucible is selected, and soaked for two or three days in linseed oil, which is then to be cleared away from the inner surface till some finer powdered glass of borax dusted upon it shall just adhere, when it is to be put into a dry place for two or three weeks, after which it is fit for use.

The gold alloy is first melted in the crucible, and then about twice its weight of coarsely-powdered sulphuret of antimony is thrown in at two or three different times. At each addition the mixture froths and swells up, so that the crucible must be larger than the quantity contained, and great caution must be observed to prevent any bits of charcoal dropping into the crucible; for then the mass of melted matter would certainly flow over. When the mixture begins to sparkle on the surface, and appears to be perfectly fluid, it is to be poured into a melting cone which has been previously heated and greased, and the settling of the gold at the bottom is promoted by communicating a tremulous motion to the cone by means of slight blows. When the matter has become cold, it is removed from the cone by giving it a few blows in an inverted position. The mass is composed of an alloy of gold and antimony, covered with scoriæ consisting of the metal formerly alloyed with the gold now in combination with the sulphur or the antimony. But the gold still retains a little of its alloy, and from this it is to be freed; the same process is to be repeated not only a second, but even a third and fourth time, with a similar quantity of sulphuret of antimony. The metals from which gold may be advantageously purified by this process are iron, copper, tin, lead, and silver.

5. *Separation of gold from antimony.*—When the proportion of antimony exceeds that of the gold, the alloy is brittle. It must be reduced to small pieces, mixed with one-fourth its weight of sulphur, melted in a covered earthen crucible, and after the fusion is completed, poured into a melting cone previously heated and greased. When examined after being cooled, it will be found to consist of two parts, which may be easily separated by melting the alloy, exposing it to a high temperature, and at the same time directing a stream of air from a pair of bellows into the crucible which contains it. By this means the antimony is oxidated, and driven off in the form of white vapour. The gold having acquired a clear bright green colour, it is to be poured out and melted again in a small crucible with a little nitre. The remaining portions of antimony will be oxidated, and driven off from the gold as before. The small proportion of gold which remains attached to the sulphuret of antimony may be separated by bringing the whole mass into thin fusion, and precipitating part of the antimony by adding about one-fifth of its weight of iron filings. In this way the gold falls down in the form of alloy with the antimony, and it may be separated by means of the process described above.

Separation of gold from lead by cupellation.—This is the most economical method of separating gold from lead. The nature of the process of cupellation, and the method of conducting it, have been already described under CHEMISTRY, N° 2026. p. 682. But besides lead, other metals may be separated from gold, by employing that metal as a flux, the effects of which in scorifying and carrying down most of the imperfect metals, are such, that by the process of cupellation with lead, which is to be repeated according to the proportion of the alloy, and its affinity for the gold, almost every particle of the metals combined with it, may be separated. This method is usually followed where the proportion of alloy is but small; but when it is more considerable, some of the other methods are preferable. It is found however, that in the cupellation of pure gold with lead, it always retains a small portion of this metal, which affects its colour and ductility. But if the alloy to be purified, contain, beside lead, to the amount of one-twenty-fourth of the gold of copper, the whole of the lead may be separated, but scarcely any of the copper; and if it contain silver in a greater proportion than that of copper, the latter may be separated by the process of cupellation, and a little of the lead remains. But if the silver exceed

Gold.

exceed the gold, or be equal to it, the copper and lead may be entirely separated, while the gold and silver remain behind. From a knowledge of these facts, the refiners, in separating the base metals from gold, by the process of cupellation, add to the mixture a considerable proportion of silver. When the gold is alloyed with tin, cupellation with lead alone will not succeed, because the tin, with part of the lead, forms a spongy and refractory oxide, and floats on the surface of the fluid metal, and at the same time retains part of the gold. But as iron is found to combine with tin into an alloy that may be scorified by lead, the addition of iron filings during the process removes the difficulty.

The following table shews the quantity of gold which is got from the different countries of the old and new world, taken on an average, between the years 1790 and 1802.

Old Continent.	*Kilogrammes.*	
Siberia,	1700	
Africa,	1500	
Hungary,	650	
Saltzburg,	75	
Norway,	75	
Total of the Old Continent,	——	4000
New Continent.		
North America,	1300	
South America—		
Spanish possessions,	5000	
Portuguese possessions,	7500	
Total of the New Continent,	——	13800
		* 17800

* Brongniart, ii. 351.

The kilogramme being equal to 2lbs. 3oz. 5drs. avoirdupois, the whole amount is equal to about 39,285 pounds avoirdupois.

Chap. III. *Of the Ores of Mercury.*

The ores of mercury present less variety than those of many other metals; and on account of its peculiar properties, the management of its ores, whether for the purposes of analysis or reduction, is less complicated and difficult.

Sect. I. *Of the Analysis of the Ores of Mercury.*

To analyze the ore of native mercury, or native amalgam, it is to be digested in nitric acid of moderate strength; the mercury and silver, and bismuth, will be dissolved, and if the ore should contain a minute portion of gold, it will remain untouched in the form of a brown powder at the bottom of the solution. The nitrous solution is next to be gently evaporated till it is so far concentrated as to be on the point of crystallizing. It is then to be poured into a large quantity of pure water, by which means the most part of the bismuth will be separated, and a solution of common salt, or any other neutral muriate, being added to the filtered liquor, the silver and mercury will be precipitated in the form of muriate. After this is separated, add to the clear liquor some carbonated alkali, while any precipitation takes place; then boil the liquor, and separate the precipitate by filtration. The muriatic precipitate is next to be digested in nitro-muriatic acid moderately diluted, which takes up every thing excepting the muriate of silver, from which, after being washed and dried, the proportion of silver in the ore may be easily ascertained. The nitro-muriatic solution is now to be decomposed at a boiling heat, by a carbonated alkali, and the white precipitate thus obtained being added to the former carbonated precipitate, mix them with a little oil, or what answers better, sugar, and distil in a small coated glass retort. Raise it gradually to a red heat, and continue at that temperature while any mercury comes over. The residue in the retort consists of a little metallic bismuth and charcoal.

Mercury.

Native amalgam.—With the view of ascertaining the proportion of mercury and silver in this ore, Klaproth examined some of the garnet-like crystals from the quicksilver mines of Deux Ponts. Some pure crystals weighing $33\frac{1}{3}$ grains were introduced into a barometer tube of a larger diameter than usual, and closed at the lower end. This end was placed in sand, within a small crucible; heat was applied, and its intensity gradually increased to the degree of ignition. After cooling, he cut off the lower end of the tube, and found that it contained the silver, which had undergone ignition in its former crystalline form, and weighing 12 grains. On collecting the mercury which had been sublimed in the tube, he obtained 21 grains. Therefore since the deficiency of one third of a grain may be reckoned as a loss of quicksilver, the following will be the proportion of the parts in 100 of this crystallized amalgam of silver.

Silver,	36
Mercury,	64
	100

Cinnabar.—The analysis of cinnabar may be conducted in the following manner. The ore being reduced to a fine powder, is repeatedly digested in a mixture of 1 part of nitric acid, and 3 of muriatic, moderately diluted, by which every thing in the ore is dissolved excepting the siliceous earth and the sulphur. The residue being washed, dried, and weighed, is subjected to a red heat, and the remaining silex being deducted, the difference of weight shews the amount of the sulphur. The nitro-muriatic solution is next to be decomposed at a boiling heat, by carbonated alkali, and the precipitate obtained being mixed with a little lamp-black, and distilled, the mercury passes over in the metallic form. The residue in the retort consists of magnetic oxide of iron, and any accidental earth excepting silex that is contained in the ore, together with a little charcoal, which may be separated in the usual way.

Hepatic ores.—The hepatic ores of mercury, and such as contain bituminous substances, may be treated in the same way; but these ores are sometimes combined with a little silver, and therefore the matter which remains undissolved in nitro-muriatic acid, may be muriate of silver, as well as sulphur and silex. When the sulphur is burnt off, the residue is to be mixed with twice its weight of pearl-ash, and being strongly ignited in an earthen crucible, diluted muriatic acid is added, by which the alkali and the earth will be taken up, and the

Mercury.

the silver will remain behind in the form of small metallic grains.

Corneous ore of mercury.—To analyze this species of mercurial ore, let it be digested in a little distilled vinegar, by which the native mercury which is dispersed though the ore will be left behind. Add to the clear solution nitrate of barytes, by which the sulphuric acid will be separated in the state of sulphate of barytes; and this being removed, drop in nitrate of silver, by which the muriatic acid will be separated in the form of muriate of silver. The mercury now remains in solution in the state of nitrate, and being precipitated by means of iron, it is afterwards washed in muriatic acid, and thus appears in the metallic state. It may also be reduced to the metallic state by precipitating by carbonated alkali, and distilling the precipitate with a little lamp black.

A simple and easy process is followed in assaying the ore of mercury in the dry way. The ore to be examined is first to be reduced to powder, and carefully mixed with one-fourth of its weight of quicklime, and an equal portion of iron filings. It is then to be exposed to a red heat in an iron or earthen retort, as long as any mercury passes over into the receiver.

Sect. II. *Of the Reduction of the Ores of Mercury.*

A very simple process is followed for reducing the ores of mercury. The following is the method practised at the celebrated mines of Almaden in Spain. The pieces of pure cinnabar are first selected and separated from the ore, to be sold to painters and manufacturers of sealing-wax. The rest is sorted into three parts, of which the first is the richest, and is broken into pieces of a moderate size; the second, containing a smaller proportion of metal, is broken into smaller pieces; and the third consists of the dust and smaller fragments of the other two. These are kneaded up with clay, and being formed into bricks, are carefully dried in the sun. The furnace which is used for extracting the mercury is built in an oblong form, and is divided horizontally by an iron grate, into an upper and lower compartment, and near its top it communicates with a series of aludels. In charging the furnace, a stratum of flat rough stones is placed on the grate, intervals between each of the stones being left for the passage of the fire. A bed of ore of the second quality is laid on the stratum of stones, and then a stratum of the ore of the first quality, after which another of the second kind, and last of all a stratum of the third kind, which has been made up into bricks. A few faggots are then thrown into the lower cavity of the furnace, and lighted up; and a gentle fire is to be kept up by occasionally adding faggots for eight or twelve hours, according to the previous state of the ore with regard to moisture. After the moisture is separated, which is known by the vapour ceasing to be exhaled, the fire-place is filled again with faggots, and by the time they are consumed, a sufficient heat will be communicated to the ore, to allow the combustion to go on, by means of the sulphur which it contains, without requiring any more fuel. In the course of the next two days, while the sulphur burns slowly away, the mercury rises in the state of vapour, and passes into the aludels, where it is condensed. When the whole of the metal is extracted, the scoria is taken out of the furnace, and the aludels are emptied of their contents. But besides the mercury, they are found to contain a quantity of black matter like soot. This matter is easily separated by spreading the whole about on an inclined table, so that the mercury may run to the lower extremity, where it is collected in a channel, and the impure sooty matter remains behind.

Mercury.

The method of extracting mercury from its ores now described, is advantageous, on account of the simplicity of the apparatus, and the smaller expence of fuel; but it would appear that a portion of the mercury remaining in the ore is lost. There is besides a considerable loss in throwing away the soot, after separating the running mercury on the tables, not only because many of the globules of the metal itself are thrown away, but also the calomel, and cinnabar, which are found to be in considerable proportion, are wasted. Hence it has been recommended as a more profitable method, 1. To separate the sulphate of ammonia, which, according to the examination of Proust, forms part of the matter deposited in the aludels, and then by mixing what remains, with 12 or 15 per cent. of quicklime, distil it in an iron retort, by which means the whole of the running mercury would be obtained, as well as that which is produced by the decomposition of the calomel and cinnabar.

A more improved process is practised at the mines of Deux Ponts, and Idria. The ore, as it is brought out of the mine, is carefully sorted by the hand, and these parts that seem destitute of metal, are rejected. This process, although tedious and expensive, is found to be more advantageous than the older method of separating the cinnabar by washing, in which there is a great loss of metal. The ore being thus sorted, it is reduced to powder, and accurately mixed with one-fifth of quicklime, which has fallen to powder by exposing it to the air; but it ought to be observed that the quantity of quick lime is to be regulated by the proportion of cinnabar contained in the ore. The mixture being thus prepared, is introduced into iron retorts, which are capable of holding about 60lbs. weight. The retorts, to the number of 40 or 50, are fixed in a long furnace, and a glass receiver is attached to each, but it is not luted. A moderate heat is then applied for the purpose of driving off the whole of the moisture; and when this is done, the joinings of the vessels are to be closely stopt with tempered clay, and a full red heat is to be applied, and continued for seven or eight hours, at the end of which time the whole of the mercury will be volatilized, and condensed in the receiver. By this process it is found, that 100lb. of the ore yield from 6 oz. to 10 oz. of metal.

Chap. IV. *Of the Ores of Silver.*

The ores of silver present a considerable variety. Sometimes it is found in the metallic state in masses of from 30lbs. to 40lbs. weight, but it is oftener combined with sulphur in the state of sulphuret; with other metals, especially antimony, arsenic, iron, copper, lead, and bismuth; or with acids, as the carbonate and the muriatic, forming the carbonate and muriate of silver. The analysis and reduction of these different ores, it is scarcely necessary to observe, must be conducted according to the

Silver.

the nature and proportion of the ingredients which enter into the composition of the ore to be examined or reduced.

Sect. I. *Of the Analysis of the Ores of Silver.*

When a silver ore is to be examined, and the only object in view is to ascertain the proportion of silver it contains, the operation is usually conducted in the dry way. The ore is first roasted and reduced to powder; it is then mixed with litharge in proportion to the earthy matter combined with the ore, and quickly vitrified. The mass thus obtained is again reduced to powder, and being mixed with black flux, is to be fused in a crucible, with a sufficient degree of heat. By this process the lead of the litharge is revived, and collected at the bottom of the crucible, carrying with it the whole of the silver, as well as some of the other metals which may be combined with the ore. The button thus obtained is to be subjected to the process of cupellation, with the requisite quantity of pure lead, and in this way the base metals are scorified, and the silver remains behind in a state of purity, or combined only with the gold, which many of the ores of silver contain in small proportion. The gold is to be separated by some of the methods which we have already described, in treating of the ores of gold. This operation, in which the object only is to ascertain, as in this case, the quantity of silver, is called *assaying*. In the examination of ores in this view, more assays then one should always be performed, that an accurate and nearly invariable result may be obtained.

But in examining metallic ores, it is always more satisfactory to ascertain the whole of the ingredients of which they are composed. We shall therefore proceed to give an account of the best conducted analysis of the ores of silver.

Corneous silver ore.—The following is the analysis or this ore by Klaproth.

" Upon 200 grains of the corneous silver ore I poured three times their weight of pure nitric acid; but no action took place, either in the cold or in the heat of boiling; only a subtle brown red iron-ocbre was separated, which, being washed off from the remaining ore, and dried, amounted to four grains. Caustic ammonia, added to the nitric acid employed, precipitated five grains more of iron. When it was afterwards mixed with muriatic acid, only a pale milky colour was produced, but no real corneous silver ore deposited. It followed from this, that neither any free native silver, nor any portion of it mineralized by sulphur, had been contained in that ore. The horn-silver, after treatment with nitric acid, was reduced by twice its weight of salt of tartar, and yielded 133 grains of reguline silver.

" 1. For the purpose of finding out, more accurately, its constituent parts, I mixed 200 grains with 600 grains of the purest alkali prepared from tartar, and brought the mixture into the state of fusion in a glass retort, applying the necessary degree of heat. After refrigeration, I broke off the upper half of the retort, softened the fused mass, which was of a light-brown colour, with hot distilled water, filtered the whole, and edulcorated the residue.

" 2. This residue was then dissolved in nitric acid. The solution acquired a brown tinge, and the scum floating upon the liquor assumed the colour of bricks. When the argenteous parts were completely dissolved, there remained $8\frac{1}{2}$ grains of a brown-red powder, which imparted a golden yellow colour to the aqua regia, with which it was digested, and left a white residue behind. This last consisted of horn-silver, mingled with a slight portion of the gangue, or matrix of the ore, and afforded, on reduction, two grains more of silver. Caustic ammonia precipitated from the yellow solution seven grains of oxyded iron.

" 3. The nitric solution of the silver was precipitated by common salt; and the muriate of silver thus obtained weighed, after reduction by means of soda, $134\frac{1}{2}$ grains of reguline silver.

" 4. The fluid, left after the separation of the horn-silver, had a pale-yellow colour, owing to a portion of iron; which, precipitated by pure ammonia, weighed five grains.

" 5. After this, I proceeded to examine the saline mass, dissolved in distilled water, and separated from the silver, after the corneous ore had been fused with pure alkali. On saturating this mass with distilled vinegar, the solution was rendered turbid, and a loose white earth deposited, which, collected and dried, amounted to three grains and a half of argillaceous earth.

" 6. The alumina being separated, the solution was reduced to a dry salt by evaporation, and the alcohol, affused upon it, took up the acetite of pot ash. The neutral salt, which was left behind by this process, and which consisted of the mineralizing muriatic acid and the alkali employed, I dissolved in water, and obtained from it, by repeated evaporation and crystallization, $117\frac{1}{2}$ grains of muriate of potash.

" 7. In order to learn whether and in what proportion sulphuric acid, which by some writers has been mentioned as one of the constituent parts of the corneons silver ore, were really present in it, I again dissolved that salt in distilled water, and dropped into it liquid muriate of barytes. The mixture became turbid, exhibiting that appearance which indicates the presence of only a slight quantity of sulphuric acid. I continued to add the barytes, until no more turbidness appeared. The weight of the precipitate thus obtained was three grains: but, as in these three grains of sulphated barytes the acid cannot properly be estimated to be more than half a grain, I think this quantity is too trifling to be considered as one of the essential constituent parts of the corneous silver ore. But if that half grain of sulphuric acid be estimated equal to $1\frac{1}{2}$ grain of sulphur of potash, and be subtracted from the above $117\frac{1}{2}$ grains of digestive salt, or muriate of potash, there will remain of the latter only 116 grains, in which the concentrated muriatic acid amounts to 42 grains. Therefore,

" One hundred parts of this corneous ore contain

Silver,	67.75
Muriatic acid,	21
Oxide of iron,	6
Alumina,	1.75
Sulphuric acid	0.25
	96.75."

Red silver ore.—The following is the analysis of this ore, also by Klaproth.

" Upon

Silver.

"Upon 500 grains of bright, crystalline, red silver-ore, most finely pulverized, I poured six times their quantity of a mixture of equal parts of nitric acid of 1.350 specific gravity and distilled water. The phial was kept for several hours in a low digesting heat, so that the agency of the acid would be but moderate. I then diluted the solution with water; caused it to boil; and, after the residuum had subsided to the bottom, I decanted the clear solution. Upon the remaining pulverulent ore, a quantity of nitric acid and water, equal to the preceding, was again affused; and, in the same manner, proceeded with as at first. The ore appeared now to have been effectually decomposed; and for this reason the solutions, together with the residuum, were put on the filter, and the latter properly washed.

"The filtered nitric solution had no colour at all, having been very much diluted by the water by which the residue had been edulcorated. I subjected it to evaporation to $\frac{1}{8}$th part, and found the bottom of the evaporating glass vessel, after cooling, covered with copious, finely grained, resplendent, and heavy crystals of a gray white. To ascertain their nature, I procured, by a separate process, a quantity of a solution of the same red silver-ore, sufficient for this enquiry, and found that they were sulphate of silver. Being assured of this, I dissolved that sulphate by a proportionate quantity of water, assisted by heat, added it again to the nitric solution, and combined this last with muriatic acid, as long as any muriate of silver would precipitate; which, when collected, edulcorated, and dried, was found to weigh $391\frac{1}{2}$ grains.

"The fluid, from which the horn-silver had been thus separated, was then reduced to a smaller bulk, by distillation from a retort. This concentrated fluid became turbid, and left another grain of muriated silver on the filter. At this time it contained no other foreign substance, except a considerable portion of sulphuric acid.

"What remained undissolved by the nitric acid, consisted of an ash-gray, pretty loose, or flocculent powder, of 202 grains in weight. When this had been gently digested for half an hour, with a mixture of five parts of muriatic acid, mixed with one part of the nitric, and then diluted with half its quantity of water, there remained, after filtering, careful edulcoration, and drying, 65 grains; which were the sulphureous contents of the ore. When this residue had been gently heated, the sulphur deflagrated, leaving $6\frac{1}{2}$ grains of muriated silver behind. This sulphur, therefore, consisted of $58\frac{1}{2}$ grains.

"After the filtered solution had been evaporated in part, it was poured into a large quantity of water. By management, a white precipitate immediately ensued, which being separated by the filter, edulcorated, and dried, and lastly heated in a porcelain cup, gave 133 grains in weight. But I could not find the least trace of arsenic in it, though I had subjected it to all the trials deemed proper for discovering its presence. On the contrary, it was manifest, that this precipitate wholly consisted of oxide of antimony, quite of the same nature with that which is produced when muriatic solutions of antimony are precipitated by water. On exposing it to heat, a small portion of moisture still evaporated, attended with a muriatic smell, which was hardly perceptible. When again put on a test, and mingled with a third part of charcoal dust, the coaly powder was slowly consumed, by burning, without any arsenical smell, and left behind it the metallic oxide, possessed of a gray colour, and partly blended, partly covered, with a quantity of fine, gray-white, shining, acicular crystals, or the flowers of antimony, as they are called. But when it was fused in a covered crucible with tartar and powdered charcoal, it was completely revived into reguline antimony, which being blown off with the bellows, a bead of silver was left, weighing half a grain.

"The liquor also, from which the antimonial oxide was separated, contained free sulphuric acid. On this account, I put it into a retort, together with the nitric acid, from which the silver had been precipitated in the state of horn-silver, by means of muriatic acid, and continued the distillation until, at this temperature, nothing more would pass over; but, on raising the heat, thick white vapours had begun to rise. The fluid left behind in the retort was found upon trial, to be concentrated sulphuric acid. Upon diluting this last with water, and subsequent affusion of muriated barytes, the sulphate of barytes from thence produced, amounted, after edulcoration and desiccation, to 194 grains.

"Consequently, the constituent parts discovered by these researches, are, silver, antimony, sulphur, and sulphuric acid *."

* Essays.

Vitreous silver ore.—This has been also analyzed by Klaproth, according to the following method.

"1. If ductile vitreous silver ore be fused upon a piece of charcoal, by the assistance of the blow-pipe, its sulphur is quickly volatilized, and a button of pure silver remains. But it is otherwise with the brittle ore: for the bead left after the evaporation of the sulphur is brittle, and cannot be purified by the addition of borax. However, if a little nitrate of potash be added to the red-hot bead, it will destroy the portion of baser metal which it contains, and then the borate of soda causes it to yield a pure button of silver.

"2. One hundred grains of ore, previously levigated, were gently boiled in a sufficient quantity of nitric acid, diluted with an equal quantity of water. This operation was repeatedly performed, till the black colour of the powdered ore disappeared, and the insoluble portion had become of a loose texture, and had acquired a gray-yellow colour. When filtered and dried, this residue weighed 26 grains.

"3. On adding a solution of common salt to the above filtered solution, which had assumed a pale-greenish colour, a copious precipitate of horn-silver ensued, which, edulcorated and dried, gave $88\frac{1}{4}$ grains. Four parts of this afforded three of silver, by fusion with soda.

"4. The remaining solution was next combined with sulphate of soda; but neither any turbidness, nor any indication of the presence of lead, appeared. Upon this, caustic ammonia was affused to excess; and the gray precipitate, which then fell down, and which the volatile alkali could not again render soluble, weighed five grains. Urged by heat, it melted into a consistence like pap, at the same time that a weak arsenical smell was perceived. After this precipitate had been once more dissolved in nitric acid, the addition of soda caused it to yield a whitish yellow, alkaline sulphuret a dirty brown, and Prussian alkali a deep blue precipitate, liable to the attraction of the loadstone, after ignition. Therefore, it consisted of iron, with a slight trace of arsenic.

Silver.

"5. The proportion of copper, indicated by a blue colour, in consequence of the addition of ammonia, and which still remained in the solution, was but slight. For, after the solution had been saturated with sulphuric acid, polished iron immersed in it, was invested with so slight a coppery crust, that no copper to any amount could be collected.

"6. Those 26 grains, which continued insoluble in the nitric acid (2.), were digested in nitro-muriatic acid, till nothing appeared to remain but the mere sulphur. Its weight amounted to 13 grains; but after deflagration, it left behind it about one grain of quartzose matter of the mine.

"7. From this it is obvious, that 13 grains, or one-half of the above 26 grains, were held in solution by the nitro-muriatic acid; and these were precipitated entirely in the form of a white powder, upon the affusion of 20 parts of water. When ignited, this precipitate assumed a yellowish colour; but there was nothing either of arsenic, or any other volatile substance, perceivable. By combination with soda, it became reduced to pure reguline antimony; which, as such, admitted of being blown off, without leaving any residue, in its usual form of a thick white smoke, adhering to the contiguous bodies in the form of needle-shaped flowers (oxide) of antimony. Those 13 grains of oxided antimony are equivalent to ten grains of that matter in the reguline state *."

* *Essays.*

For the analysis of some of the other ores of silver, we must refer our readers to the ingenious and elaborate Essays of the sagacious Klaproth, from which we have extracted what is given above on this subject.

Sect II. *Reduction of the Ores of Silver.*

Although the ores of silver contain a larger proportion of extraneous matters than the ores of some other metals, the value of that metal being greater than that of many others, admits of greater expence in the processes employed for their reduction. The ores of silver are reduced either by fusion, or amalgamation.

Reduction of silver ores by fusion.—Native sulphuret of lead, or galena, commonly contains a portion of silver, and often in such quantity, as to make its separation from the lead a profitable undertaking. The proportion of silver contained in lead is very variable. The greatest produce of silver which we have heard of, was got from the lead ore of Craven in Yorkshire, which amounted to 230 ounces of silver in the ton of lead. The mines of Cardiganshire yielded formerly 80 ounces per ton; the Durham and Westmoreland mines afford lead, from which 17 ounces of silver are obtained upon an average per ton. The lead procured from the mines of Islay, one of the Western islands of Scotland, yielded, we have been informed, 40 ounces per ton; and the average produce of lead at the refinery at Poullaouen, in Brittany in France, is above 39 ounces of silver per ton. The following is the process carried on at the latter establishment, for separating the silver from the lead.

After the lead has been extracted from the ore, the object of the refiner is to obtain the silver in a separate state, which is dispersed through the mass of lead. This is performed by the process of cupellation on a large scale, or refining, as it is usually termed. The floor of the reverberatory furnace, in which the process is conducted, is horizontal, and it is lined with wood ashes and sand mixed together, and well beaten, and formed into a shallow bason, which is the cupel. There is an aperture at one side of the cupel, which forms a right angle with the flue by which the flame from the fireplace passes into the cavity of the furnace. Through this aperture the lead, brought to the state of litharge, runs; and opposite to it there is another aperture by which a blast of air is admitted. The top of the furnace has a circular aperture directly above, and corresponds in extent with the cupel, which may be shut up with a frame work of iron filled with bricks. When the furnace is ready, the cupel is lined with hay, and is then charged with about 177 quintals of lead, in bars or pigs, through the circular aperture, and the cover being put on, the fire is lighted up. In the course of six hours, the whole of the lead being melted, and brought to a red heat, a blast of air is directed upon the surface of the lead, and the ashes of the hay, and other impurities are removed with a wooden rake. The blast being continued for half an hour and more, the surface of the lead begins to be covered with a thick crust of oxide, which is scraped off, and is soon succeeded by another, but it is not till the surface has been cleared five or six times that the true litharge appears. When this is the case, the temperature is raised to a cherry red, and by the action of the blast, with the occasional aid of the workman, the litharge flows out through the aperture mentioned above. The intense heat volatilizes a considerable portion of lead, and so fills the interior of the furnace with vapour, that a person of experience only can discover what is going on in the cupel. At the end of 38 or 40 hours from the time that the fire is lighted, the contents of the cupel are reduced to about six quintals, and the litharge which comes over at this time is kept separate, because it contains a small portion of silver. At last the litharge ceases to flow, and the surface of the melted metal appears covered only by a thin pellicle. It then becomes gradually convex at the edges; the pellicle breaks up, and the surface of the metal appears quite bright. The blast is now to be turned off, the fire damped, and an aperture in the furnace, previously stopped with clay, is opened to admit a tin plate tube, through which a stream of water is poured into the cupel, in order to cool the metal rapidly, that it may be prevented from spirting, which would be the case, if this precaution were not observed at the moment of congelation. But the silver thus obtained is still contaminated with a portion of lead, from which it is freed by a second cupellation, which is performed in a moveable cupel containing about 700 or 800 ounces, and is placed in a small reverberatory furnace, which being heated about three hours, is charged with silver of the first cupellation. After the fusion of the silver, a proper working heat is kept up for four or five hours, when the refining is usually completed. The loss of lead by volatilization during the refining process is estimated at about eight per cent. When the quantity of litharge produced is large, it is reconverted into lead, by being returned into the reverberatory furnace, and treated in the same manner as the ore. This forms lead of the best and softest quality, because it is in a state of the greatest purity. And besides, the scoriæ that remain after the reduction of the ore, and the litharge, along

Silver. along with the old cupels, and the metallic soot which is deposited in the chimney of the furnace, are treated in a common blast furnace, and a considerable portion of lead is thus obtained.

A different practice is followed in the English refineries. A common reverberatory furnace, having the area perforated with a large oval hole to receive the cupel, is employed. The cupel is formed of six parts of well burnt bone ashes, and one of good fern ashes, mixed together, and moistened to a proper consistence. A quantity of this mixture is strewed to the depth of about two inches in an iron frame, which consists of a raised elliptical rim, with five broad bars rivetted to its bottom, so as to occupy nearly one-half of its area. The ashes are rammed down very close with a wooden beater, and particularly within the bars of the frame, as it is laid on a flat floor. More ashes are then added, and beaten carefully in, till the frame is quite full. By means of a sharp-edged spade, five inches square, a cavity is formed in the test for containing the melted metal, and at one end of the frame a semi-elliptical hole is cut through the breast, which latter is to be left of sufficient solidity and thickness. The test is now to be turned on its side, and dressed from all superfluous ashes adhering to the bottom, taking care that none shall be left flush with the bottom of the frame or cross bars, otherwise the test might be bulged, by fixing it at the bottom of the furnace. The rim being plastered with clay or moistened ashes, the test is placed upon the supporting cross bars, and fixed firmly with wedges against the bottom of the furnace, the breast being next to the feeding hole. A moderate heat is now applied, and gradually increased till the test be red hot; and when it ceases to emit steam from the under side, it is sufficiently dry. This previous preparation being completed, the following is the method of operation as it is described by Mr Sadler *.

"Lead previously melted in an iron pot is ladled into the test until the hollow part be nearly filled, the operator closes the feeding aperture, and increases the heat of the furnace until the surface of the lead is well covered with litharge; he then removes the door from the feeding hole, and with an iron rod, which has one end bent down at right angles about three inches, and made flat or chissel-shaped, scrapes the small gutter or channel until the litharge just flows into it; the blast from a pair of double bellows is then directed from the back part over the surface of the test, the litharge is urged forward, and flows from the gutter upon the floor of the refinery; the operation now goes forward, gradually adding lead as the escape of litharge makes it necessary, until the gutter is so worn down that the test does not contain more than an inch in depth of lead, the blast is then taken off, the gutter filled up with moistened ashes, and a fresh one made on the other side the breast; the test is again filled, though not so full as at first, and the operation carried on until this gutter also is worn down and the test contain from about 50 to 70 pounds of alloy. This quantity is run into an iron pot, and set by until a sufficient number of pieces have been collected to make it worth while to take off a plate of pure silver from them.

"The quantity of alloy left in the working off each test must depend in a great measure upon the quantity of silver which by estimation it is supposed to contain. A sufficient quantity of lead should always be left in the alloy to make it fuse easily in the iron pot.

"When the test is removed from the furnace and broken up, the litharge will be found to have penetrated to an inconsiderable but an equal depth in the ashes; that part not impregnated with litharge may be pulverized, mixed with fresh ashes, and again used for another test.

"The operation of taking off the silver pure differs in no respect from the foregoing, only more care is observed in the working, not to suffer the escape of any metallic particles with the litharge, as that would occasion considerable waste of silver. As the process advances, and the proportion of silver to lead increases, the litharge assumes a darker colour, a greater heat becomes necessary, and at last the brightning takes place; the interior of the furnace, which during the whole of the process had been very obscure and misty, clears up. When the operator observes the surface of the silver to be free from litharge, he removes the blast of the bellows, and suffers the furnace to cool gradually; as the silver cools many protuberances arise on the surface, and fluid silver is ejected from them with considerable force, which falling again on the plate, spots it very fantastically with small globules.

"The latter portions of litharge bring over a considerable quantity of silver with them; this is generally reduced by itself and again refined.

"The litharge as it falls upon the floor of the refinery is occasionally removed; it is in clots at first, but after a short time as it cools it falls for the most part like slaked lime, and appears in the brilliant scales it is met with in commerce: if it is intended as an article for sale, nothing more is necessary than to sift it from the clots which have not fallen, and pack it in barrels.

"If, on the contrary, it is intended to be manufactured into pure lead, it is placed in a reverberatory furnace, mixed with clean small-coal, and exposed to a heat just sufficient to fuse the litharge. The metal as it is reduced flows through an aperture into an iron pot, and is cast into pigs for sale. During the reducing, care is taken to keep the whole surface of the litharge in the furnace covered with small-coal.

"In some smelt works, instead of a reverberatory furnace for reducing, a blast furnace is made use of, on account of the greater produce, but the lead so reduced is never so pure as that made in the wind furnace. The oxides of the metals, which require a greater heat to reduce than the lead, are in the blast furnace generally reduced with it.

"The volatile oxides, as zinc, antimony, and arsenic, are mostly carried off by evaporation during refining; a considerable portion of the oxide of lead itself is carried off by evaporation, making the interior of the furnace so misty and obscure that a person unused to refining cannot see more than a few inches into it.

"A considerable portion of these oxides is driven by the blast of the bellows through the feeding aperture, and would be dissipated in the refining-house, to the great injury of the workmen's healths; to prevent their ill effects, the arch or dome over the feeding hole is erected to carry the fume into the stack of the furnace."

We shall now describe the method of treating the proper

* Nichol. Journ. xxv. 2.

Silver.

proper ores of silver, as it is conducted by Schreiber at Allemont in France. These ores are native silver, and the sulphuret of silver mixed with arsenical cobalt, pyrites, iron ochre, clay, calcareous spar, and some other earthy minerals. The silver being dispersed in very minute grains through the gangue, cannot be separated from the stony parts by washing. After the ore is picked by the hand, it is pounded dry in the stamping mill, and is reduced to the consistence of coarse sand. Roasting, previous to fusion, is not required; but the ore being refractory, it is found necessary to employ a flux composed of quicklime, scoriæ from a preceding fusion, and slag from the iron forges. To supply the proper quantity of lead, powdered galena, with the litharge and scoriæ furnished by the refinery, and with old cupels ground to powder, is added to the ore in such proportions that the lead, which is obtained by the fusion, may contain two per cent. of silver, allowing 20 per cent. of the lead at least to be lost by evaporation, or combining with the scoriæ. After being properly mixed, the materials are subjected to the heat of a powerful blast-furnace, with alternate charges of charcoal. The products of the fusion are lead combined with silver, a black, compact, sulphureous, semi-metallic substance which is called *matt*, and some scoriæ. The scoriæ thus obtained is neglected, excepting a certain proportion, which is reserved as a flux for the next parcel of ore. But the matt, which is tolerably rich in silver, is again melted with litharge, and the lead carries with it almost the whole of the silver; and although this second matt contain a portion of silver, it is not found worth while to subject it to a second fusion. After refining the lead procured by these operations, it is found to yield about two per cent. of silver. The process of cupellation is performed at a higher heat than usual, which it is supposed is necessary by the presence of a small portion of iron; but the consequence of employing this high temperature is to increase the waste of the metal by evaporation; for instead of seven or eight per cent. it amounts to no less than 20 per cent. And as every pound avoirdupois of the lead thus volatilized, contains from six to ten grains of silver, the loss in this process is very great. Perhaps it might be diminished by mixing a larger proportion of lead with the silver ore.

But other silver ores afford both lead and copper, and in this case a more complicated operation becomes requisite. In the first part of the process the poorest kinds of silver ore, or such as contain but a small proportion of copper and lead, and a great deal of stony matter, are to be mixed with the poorer pyritical ores, or such as contain little silver and copper, and a great deal of sulphur and iron. A portion of scoriæ obtained from a former process, and containing the oxides of lead and copper, with some silver, is added to this mixture by way of flux. The materials thus prepared being exposed to heat in a blast-furnace, re-act on each other, and enter into fusion. The stony matter is dissolved, and the melted mass separates into two distinct parts, of which the heaviest occupying the bottom of the furnace forms about one-fourth of the whole mass. This is called *matt*, and contains all the silver, with the greater part of the copper, most of the lead, iron, and sulphur, and generally zinc and arsenic. The slag which swims on the surface, as being the lighter portion, consists of the greater part of the sulphur, oxide of iron, and earthy matters; the small proportion of lead and copper is not worth the trouble of extraction.

To drive off part of the sulphur and other volatile impurities, the crude matt obtained in the preceding operation is roasted, and being mixed with one and a half times its weight of a richer kind of silver ore, and twice its weight of lead scoriæ, by way of flux, it is again fused, and thus a rich matt is procured, which may contain from nine to ten pounds of lead, from three to four pounds of copper, and from six to seven ounces of silver in the quintal, besides a quantity of scoriæ which holds a little silver, and which may therefore be successfully employed as a flux in subsequent fusions. This rich matt being roasted, is mixed with half its weight of litharge and scoriæ in equal proportions, and again subjected to fusion. The product of this fusion is a quantity of metallic lead, containing from six to eight ounces of silver in the quintal; a similar quantity of copper matt, which contains from 30 to 40 pounds of copper, and about four ounces of silver in the quintal; and lastly a quantity of scoriæ, which contains from six to 10 pounds of lead, and about 40 grains of silver in the quintal.

The copper matt of the above operation is next roasted, and fused with a quantity of lead and copper scoriæ, and the product obtained is black copper, which contains from 60 to 80 pounds of copper, and from five to ten ounces of silver in the quintal. This black copper being melted with litharge and scoriæ, the most part of the silver combines with the lead, and after one or two fusions, the copper is entirely freed, not only from the lead and silver, but also from the sulphur, iron, and other impurities.

Liquation.—The affinity between lead and silver is much stronger than the affinity between lead and copper. In consequence of this affinity, lead and silver are easily separated from copper, by being exposed to a moderate heat. This process is called *liquation* or *eliquation*. When the black unrefined copper, or copper matt, contains the proper proportion of silver for this operation, it is first used with lead or litharge, or with a mixture of the two, and an alloy consisting of copper, lead, and silver, is thus obtained. This is cast into moulds, so that the metallic product shall be in the form of round masses or loaves, which being set in a furnace on an inclined plane of iron, with a small channel grooved out, are exposed to a moderate red heat. By this process the lead melts, or, as it were, sweats out of the loaf, and carrying the silver along with it, on account of its stronger affinity for this metal, runs down the groove, while the copper remains behind as a dark red spongy mass. The lead containing the silver being subjected to the process of cupellation, the latter is obtained separate. But, in adopting this process, the proportion of the three metals must be attended to. The lead should not be more than four times the weight of the copper, otherwise the alloy becomes so fusible, that part of the copper will be melted and carried along with the lead and silver; or, if too great a degree of heat is applied, the whole loaf of liquation will be fused, and the process must again be repeated. The proportion of lead should at least be $2\frac{1}{2}$ times the quantity of copper, otherwise a considerable proportion of it, and also part of the silver, will remain in the loaf after heating. But as this process is now more rarely followed, we we shall not enter into any farther detail of the particulars connected with it.

Reduction of silver ores by amalgamation.—This process, by which silver ores are reduced, and which is now pretty generally followed in different parts of Europe, was first practised by the Spaniards in South America. The ores which are subjected to amalgamation, are such as contain only a small quantity of lead or copper; but it is of some importance that there should be a certain proportion of iron pyrites, and if this proportion be not naturally mixed with the ore, it is a good practice to supply the deficiency, by adding what is wanting to the dressed ore, so that the pyritical contents may, as nearly as possible, be in a certain proportion to the quantity of silver, which is to be ascertained by previously assaying a portion of the ore.

The ore being reduced to the consistence of coarse sand, is carefully mixed with common salt, in the proportion of eight or nine per cent. when the silver in the ore amounts to eight ounces per quintal; and when the latter amounts to 32 ounces, or even a greater proportion, from 10 to 12 per cent. of salt is to be added. The next process is roasting the ore, in which about three quintals are spread on the floor of a reverberatory furnace, and subjected to a moderate red heat. During the roasting the ore is to be turned twice or thrice, that every part of it may be equally exposed to the heat. The first charge being withdrawn, an experienced workman knows by its appearance whether the proportion of salt be too little or too much, and, as may be required, more salt or ore is added to the unroasted parcel. When the whole of the ore is roasted, it is ground in a mill, passed through sieves, by which it is made as fine as meal, and is then prepared for the proper process of amalgamation. This is performed in the following manner. A number of small barrels, which are made to revolve rapidly on their axes by means of machinery, or fixed tubs, either open or covered, having in the centre of each an instrument resembling a chocolate mill, which may be turned rapidly by similar machinery. The tubs or barrels are filled about one-third with water, and afterwards a sufficient quantity of roasted ore and mercury, in nearly equal proportions, is introduced, so that the whole may be of the consistence of thin mud. The machinery is put in motion, and continued without interruption for 30 or 48 hours, according to the nature of the ore, when the amalgamation is completed. About a quarter of an hour after the agitation of the matter in the barrels has ceased, the greater part of it falls to the bottom, and is withdrawn by opening a hole made for the purpose. The earthy residue is carefully washed by small portions at a time, and thus a good deal of the amalgam which, from being very minutely divided, could not sink through and mix with the rest, is recovered. The earth, however, if originally rich in silver, still retains a small proportion It is therefore dried, and being mixed with about 3 per cent. of salt, is again roasted, but at a higher temperature than at first; and the process of amalgamation being again repeated, the whole of the silver is extracted. The fluid amalgam is strained through a closely woven bag, and is thus separated into nearly pure mercury and a stiff amalgam; and the latter being subjected to distillation, the mercury is driven over, and the silver remains behind. The copper, which is combined with the silver, is separated by cupellation.

The process of amalgamation is thus explained. The greater part of the sulphur of the silver and pyrites is, by roasting, burnt off, and converted into sulphurous acid, which latter, as soon as it is formed, and assisted also by the affinity of the silver for muriatic acid, decomposes the common salt, forming a sulphate or sulphite of soda, while the muriatic acid combining with the silver, forms muriate of silver. In the amalgamation which follows, the mercury, being in great proportion, decomposes the muriate of silver, and is partly converted into calomel. Hence it appears, that the loss of mercury, which is sometimes very considerable in this process, arises, first, from the conversion of part of it into calomel; and, secondly, from the extremely minute division of another part, so that it is carried off in washing the earthy residue; but the proportion of the latter depends much on management.

By the following method silver may be separated from copper, according to Napione, without the expensive and complicated process of liquation. The mixed metal is melted; a quantity of sulphur is sprinkled over its surface, while the whole is stirred about with a stick by an assistant, so that the sulphur may combine with the copper into a matt, which floats above the metal, and is to be removed with a pair of tongs, previously moistening its surface with water, to make it solid. Another portion of sulphur is next to be stirred in, and the second matt produced is to be removed in the same manner. This process being repeated a sufficient number of times, the greater part of the copper is converted into matt, holding a small proportion of silver, while the remaining copper, which retains the most of the silver, originally diffused through the whole mass, becomes rich enough to be sent immediately to the refinery. In treating the matt, it is first to be reduced to powder, mixed with common salt and quicklime, in the proportion of 12 per cent. of each, roasted for 10 hours, amalgamated as before; and after three successive roastings and amalgamations, the whole of the silver may be extracted.

Table of the quantity of Silver introduced into Commerce, taken at an average between the years 1790 and 1802.

	Kilogrammes.	
Old Continent.		
Siberia,	17,500	
Hungary,	20,000	
Austrian States,	5000	
Hartz and Hesse,	5000	
Saxony,	10,000	
Norway,	10,000	
France,	5000	
		72,500
New Continent.		
North America,	600,000	
Spanish possessions in South America,	275,000	
		875,000
Kilogrammes,		947,500,

or about 2,091,162 lbs. avoirdupois.

Chap.

Copper.

Chap. V. *Of the Ores of Copper.*

The ores of copper are very various. This metal is found native, in the state of oxide, in the state of sulphuret, and in that of salt, combined with carbonic, muriatic, phosphoric, and arsenic acids.

Sect. I. *Of the Analysis of the Ores of Copper.*

The analysis of the ores of copper, it is obvious, must vary, according to the nature of the substances with which they are combined; but as a great proportion of the ores of that metal are combined with sulphur or arsenic, when they are to be treated in the dry way, they are first roasted, for the purpose of expelling those substances. To effect this, the ore is mixed with about one half its bulk of charcoal powder, or fine saw-dust, and then subjected to a low red heat, on a flat tile or muffle, on which it should be thinly spread. The sulphur or the arsenic rises in fumes; and to accelerate the separation of these substances, the mixture should be frequently stirred, observing at the same time not to increase the heat to such a degree as to make the ore clot together, which is one of the objects in the use of the saw-dust or charcoal. When it appears that the fumes cease to rise, and the whole of the charcoal is burnt off, the part of the ore remaining is now in the state of oxide, but mixed with a quantity of sulphur or arsenic, which cannot be entirely separated by roasting, and with the earthy matters with which the ore was originally combined.

The next object is to reduce the oxides, thus obtained, to the metallic state; and in this process of reduction the oxide is exposed to a high temperature, in contact with some carbonaceous matter, and secluded from the air. It has been a common practice to add some alkaline matters by way of flux, to promote the fusion of the extraneous matters combined with the ore; but the experience and observation of more enlightened chemists have proved, that a portion of the metallic oxide is always dissolved by saline fluxes, so that by assays in the dry way with saline fluxes, a less proportion of metal than the ore really contains, is obtained from it. The loss, according to Klaproth, between the treatment of a copper ore in the dry way, and the same ore, in the moist way, amounted to no less than 9 per cent. To obviate this inconvenience, a flux is employed by some, composed of fusible glass, into which a large proportion of alkali and silica enters, without any metallic matter; or fluor spar, lime, and particularly borax. By the latter, a thinner fusion of the vitrifying mixture, than by an equal quantity of any other substance, is produced, so that a smaller proportion of borax than of the alkaline matters answers all the purposes of a flux; and thus the loss of the metallic oxide, by solution, is less.

But in reducing the pure oxides, or the carbonated oxides of copper, the method which is attended with scarcely any loss, is by subjecting them in contact with charcoal, in a covered crucible, to an intense heat. It is indeed in this way that the reduction of roasted copper ores is conducted on a large scale; but as these latter contain sulphur, arsenic, iron, and other impurities, the process must be many times repeated before the copper is brought to a malleable state.

In reducing the sulphurated ores of copper, a button of metal, of considerable purity, may be sometimes obtained by means of a single operation. The tedious process of roasting is avoided by adding to the ore two or three times its weight of nitre, and projecting it into a hot crucible. When thrown into the crucible, a deflagration takes place, in which the sulphur is burnt, and converted into sulphuric acid, which unites with the potash of the decomposed nitre. The metal being now freed from the sulphur, is in a state of complete oxidation by the nitric acid, and may be reduced by adding a flux of tartar and pitch, or other similar matters, and applying a strong heat for a sufficient length of time. But it seems to be more advisable to separate the metallic oxide after deflagration. This may be done by washing the mixture, after which the oxide is to be reduced by the proper flux.

In the analysis of copper ores in the moist way, the metal is obtained separate in three states; either in the metallic state, in the state of black oxide, or in that of green carbonate. If a polished piece of iron be introduced into an acid solution of copper, it is immediately covered with a coating of shining metallic copper, which is owing to a part of the iron being dissolved by the acid, and a corresponding portion of copper being separated from the solution. The whole of the copper may be precipitated in this way, and at last the solution contains only iron. The precipitate, which is in the form of ragged filaments, may be washed, dried, and weighed, so that the proportion of the metal in the ore examined may be ascertained. It may be added, that the precipitation is greatly promoted, by boiling for a short time, especially towards the end of the process, which produces the separation of the last portions of the copper; and it should be farther observed, that a perfect separation of copper from iron is obtained only when the solution is made in sulphuric or muriatic acid, and not in nitric acid. The method of separating copper from silver has been already mentioned. It may be separated from lead, by adding sulphate of soda to the solution, by which an insoluble sulphate of lead is obtained, and the copper remains behind. To separate copper from antimony, the oxides of copper and antimony are digested with nitric acid; the copper is dissolved, and the antimony is left. By immersing a piece of metallic tin in the solution, copper may be separated from tin; for by this means the copper only is precipitated. Arsenic is separated from copper by dissolving in nitrous acid, and adding acetate or nitrate of lead, which produces an insoluble arseniate of lead, and leaves the copper behind. In case there should be an excess of lead, the addition of sulphate of soda will throw it down in the form of insoluble sulphate. When nickel is combined with copper, it is usually conjoined with iron. Ammonia precipitates all the three metals; but, when added in excess, redissolves the nickel and copper. To obtain the latter separate, supersaturate with muriatic acid, and introduce a polished piece of iron, by which the copper is precipitated, and the nickel remains in the solution.

To ascertain the quantity of precipitated copper obtained from the examination of an ore, it is to be washed and dried, put into a small crucible, moistened with a drop or two of oil, and covered with borax. Thus prepared, it is subjected to strong heat for a few minutes, Copper. nutes, and a solid button of malleable copper is produced, which may be accurately weighed. But if the product of the analysis be in the state of green carbonate, which is obtained by adding carbonate of potash or soda to a solution of copper, the green precipitate, thus formed, is to be washed and dried at the temperature of boiling water. An hundred and eighty parts of this carbonate are equivalent to 100 of metallic copper. The quantity of copper obtained by analysis may be estimated also in the state of black oxide. If the green carbonate be boiled for a few moments in caustic potash, it shrinks and becomes a deep brownish black fine powder, which is a pure oxide of copper in its highest state of oxidation. One hundred parts of this oxide, after being well washed, and dried in a low red heat, for a minute or two, are constantly found to contain 80 parts of pure metallic copper.

We shall now give a few examples of the analyses of particular ores of copper.

Vitreous copper ore, or *sulphuret of copper from Siberia.*—The following is the mode of analysis of vitreous copper ore by Klaproth.

"1. Upon 200 grains of the ore, coarsely powdered, moderately strong nitric acid was affused, which attacked and dissolved them with frothing and extrication of red vapours. The solution was clear, and the sulphur alone in the ore was left behind, floating in the fluid, in gray, loose flocculi, without any other residue; which indicated that no antimony was present. The sulphur collected on the filter was heated in a small crucible to inflammation, and it burned with its peculiar odour, without any trace of arsenic; yet leaving a slight portion of oxidated iron and siliceous earth.

"2. The solution, which had a pure blue colour, was treated first with muriate, and then with sulphate of soda. But none of these, nor any other salt, rendered it turbid, or produced any other alteration; by which it appears, that this ore contains neither silver nor lead.

"3. To determine, with proper accuracy, the proportion of the constituent parts, I repeated the examination in the following manner Two hundred grains of the powdered ore were combined and heated with muriatic acid, to the degree of boiling. But as this alone manifested no action on it, I added nitric acid gradually, by drops, which exerted a strong attack in each instance. When the solution of the ore had been accomplished, I separated the fluid from the sulphur floating on the surface; and digested this last once more with a fresh quantity of muriatic acid, dropping into it some nitric acid, after which I collected it upon the filter. This sulphur, washed and desiccated, weighed $38\frac{1}{2}$grs. out of which, after its combustion, $1\frac{1}{2}$ grain of siliceous earth remained; so that the true amount of sulphur was 37 grains.

"4. The solution exhibited a glass-green colour. I divided it into two parts. Into one half polished iron was immersed, upon which the copper precipitated of a dendritical form, and pure metallic brilliance. It weighed $78\frac{1}{2}$ grains, when washed, and immediately desiccated in a moderate temperature.

"5. In order to ascertain the proportion of iron contained in the ore, I combined the other half of the solution with caustic ammonia added to excess of saturation. The precipitated iron remained behind, in the form of a subtle brown mud, which, collected on the filter, desiccated and ignited, weighed three grains. But as the iron is contained in the mixture of the ore, not in this calciform state, but in the reguline, which last is to the first in the proportion of 3 to 4, these three grains of oxidated iron give $2\frac{1}{4}$ of metallic iron to be added in the computation.

"Therefore, an hundred parts of the Siberian vitreous copper ore consist of,

Copper,	78.50
Iron,	2.25
Sulphur,	18.50
Silex,	0.75
	100.00†."

† Essays, i. 541.

Variegated copper ore.—This ore was analysed by Klaproth, in the following manner.

"1. One hundred grains of the pulverized ore were subjected to gentle digestion with nitric acid, whose action upon it was but moderate. From the residue, the sulphur was driven out by combustion. This residue, when a second time digested with nitric acid, dissolved in it, leaving only a slight portion of a red oxide of iron. On examining the solution, first by common salt, and then by Glauber salt, it continued limpid and unchanged.

"2. Upon 200 grains of the powdered ore, muriatic acid was affused, the mixture heated, and then combined in small portions with nitric acid. The solution, which was thus performed, had a brown colour while concentrated; but as soon as it was diluted with water, it acquired a green. The remaining sulphur was gray, tenacious, and spongy, and weighed 72 grains when dry. By slow combustion it left 35 grains, of which, after extraction by muriatic acid, five grains still remained behind. These lost one grain more of sulphur by burning, and the remaining four grains dissolved entirely in muriatic acid. Whence the quantity of sulphur amounted to 38 grains.

"3. The muriatic solution was divided into two equal parts; and the copper was precipitated from one of them by means of iron. It amounted to $69\frac{1}{2}$ grains.

"4. The other half was supersaturated with caustic ammonia, and the oxide of iron which fell down was collected. This, when moistened with linseed oil, and exposed to a low red heat, weighed 10 grains; which are equal to $7\frac{1}{2}$ grains of metallic or reguline iron.

"Thus, in 100 parts of this variegated copper ore from Norway were found,

Copper,	69.50
Sulphur,	19.
Iron,	7.50
Oxygen	4.
	100.00

"In supplying the deficiency in the sum of weights of the copper, iron, and sulphur, from the hundred, by putting oxygen in the account, I mean to characterize this last as a constant constituent part of variegated copper ore, producing in it those variegated colours: in the same manner, as in steel, in copper pyrites, and other

Copper. other metallic substances, the beginning of their oxidation is indicated by a similar diversity of colours.

"In the last-mentioned substances, however, the changeable colours are only owing to external causes; for which reason they present themselves only on the surface, when long exposed to air. On the contrary, the variegated copper ore is penetrated throughout its whole mass by the oxidating principle. This corresponds with the deficiency of weight to make up the sum of the fixed constituent parts of the ore here analysed; whereas no such loss is observable in the vitreous copper ore, treated and decomposed by the same method. It is on this account also, that the action of the nitric acid is less strong, and the disengagement of nitrous gas is less copious, in the variegated than in the vitreous copper ore *."

* Ibid. i. 545.

Malachite, or *carbonate of copper*.—Klaproth analysed a Siberian ore of this species, according to the following process.

"1. One thousand grains of compact reniform malachite, from the Turjin mines, on the Ural, were reduced to powder, and heated to complete redness in a small glass retort, connected with the pneumatic apparatus. Much carbonic acid gas was disengaged in this process, to the amount of 252 cubic inches, without reckoning that part which was absorbed by the water of the apparatus. This gas was entirely absorbed by lime water, at the same time that a proportionate quantity of carbonate or crude calcareous earth was produced. In the intermediate small receiver a moisture collected, weighing 78 grains, which, upon trial, proved to be pure water.

2. The pulverulent residue taken out of the retort appeared of a black colour, and weighed 716 grains. To serve for the following experiments, it was divided into four parts, at 179 grains each; and hence corresponding to 250 grains of rough malachite.

3. One hundred and seventy-nine grains of ignited malachite, combined with three times its quantity of black flux, were put into an assay crucible, without lining it, and covered with muriated soda. In this situation it was committed to the fire of the blast furnace, and when the coals had become red hot without the action of the bellows, it was kept melting for the space of 20 minutes. After cooling, it was observed that, in the broken retort, the whole mixture, under the covering of common salt, had run into an uniform, compact, and opaque mass, of the bright red colour of ordinary sealing-wax, and that no metallic button had been formed.

"It follows from this, that there was not carbone enough present to take up entirely the oxygen of the metallic oxide. Therefore the copper has, by means of this small remainder of oxygen still united with it, been brought into the state of red oxide of copper; and, as such, it has diffused itself uniformly through the alkaline salt.

"4. One hundred and seventy-nine grains of ignited malachite were mingled with three times their quantity of black flux, and one-tenth of powdered charcoal. When fused in this state, during 20 minutes, under a stratum of common salt, in an assay crucible not lined in the inside, they afforded a button of reguline copper, which had run well together, and weighed $136\frac{1}{2}$ grains.

"5. Another 179 grains of ignited malachite, mixed with thrice as many grains of black flux, and one-fifth part of their weight of colophony, and likewise fused for 20 minutes, under a cover of muriate of soda, in a crucible not secured by lining, yielded a well-melted button of reguline copper, weighing 138 grains.

"6. The remaining 179 grains of ignited malachite were, like the preceding, melted during the time of 20 minutes, under a cover of common salt. But the assay crucible had previously been lined with powdered charcoal, and the malachite mingled with an equal weight of calcined borax, with half its quantity of white glass, and one-fourth part of colophony, or boiled turpentine. By this process I obtained, indeed, a well-fused button of reguline copper; but with a considerable loss, as it weighed only $105\frac{1}{2}$ grains.

"In order to discover more accurately the constituent parts of the malachite, I performed the following experiments.

"7. One hundred grains of malachite, reduced to powder by trituration, were dissolved in nitric acid; which was effected without leaving any residue. The solution had a bright-blue colour, and was saturated to excess with caustic of ammonia; but the precipitate produced was entirely, and without turbidness, redissolved by the excess of the alkali. This shewed that the malachite here examined was perfectly free from iron, and similar admixtures.

"8. I combined 100 grains of triturated malachite with a sufficient quantity of sulphuric acid, previously diluted with five parts of water, and accurately weighed together with the vessel. After the malachite had been wholly dissolved, which was effected gradually, and with a moderately strong effervescence, the loss of weight, occasioned by the carbonic acid gas that was extricated, was found to consist of 18 grains.

"9. One hundred grains of the same powdered malachite were ignited, at a moderate heat, in a covered crucible. The black residue had lost $29\frac{1}{2}$ grains in weight. If from these be subtracted 18 grains for the carbonic acid, the remaining $11\frac{1}{2}$ grains of loss will consist of water.

"10. And lastly, 100 grains, which had been dissolved in diluted sulphuric acid, and precipitated by zinc, yielded 58 grains of pure copper.

"In consequence of these experiments, the Siberian malachite consists, in the 100, of,

Copper,	58.
Carbonic acid,	18.
Oxygen,	12.50
Water,	11.50
	100.00 *."

* Ibid. i. 550.

Muriate of copper.—This ore, when exposed upon charcoal to the action of the blow-pipe, gave to the flame a blue and green colour; the muriatic acid was soon driven off, and a metallic button of pure copper remained.

This ore of copper was examined and analyzed by Klaproth in the following manner. A portion of the ore being reduced to powder, and boiled with water, communicated no colour to the solution; and, with the addition of a solution of nitrate of silver, afforded a small quantity of a white precipitate which blackened

Copper. in the day light. This experiment shews, that the proportion of muriatic acid is too small to give a compound soluble in water.

" 1. One hundred grains of the elutriated mineral dissolved readily and quietly in nitric acrid affused in the cold. The solution possessed a pure blue colour, and deposited a little of a brown iron ochre, which, separated by filtering, weighed a grain and a half. It was then diluted with water, and treated with a nitric solution of silver. The precipitated muriate of silver, when edulcorated, dried, and melted at a moderate degree of heat, in a silver pan, weighed 64½ grains.

" One hundred parts of metallic silver yield by such combination 133 parts of muriated silver. But as this metal, to be rendered soluble in acids, takes up 12 per cent. of oxygen, these must be subtracted; so that of this increase of weight by 33 parts, there remain 20½ for the muriatic acid.

" These principles being laid down, the above 64½ grains of muriated silver will fix the proportion of the muriatic acid, contained in 100 parts of the ore, very nearly to 10 grains.

" 2. That I might be sure of having completely separated the muriatic acid from the nitric solution of this copper ore, I added the nitrated silver in a small degree of excess; and this silver I afterwards threw down with muriatic acid, and filtered it off. Which done, the copper was precipitated in the metallic state, by means of a piece of polished iron immersed in the solution. It amounted to 57½ grains when collected and carefully dried.

" The copper, however, is contained in the ore as an oxide. In this state its weight is increased 25 per cent. by the oxygen; which, for those 57.50 grains of metallic copper, just now mentioned, gives, by calculation, 14.38 grains.

" Now, since what is deficient from the first weight of the ore employed is to be considered for the greatest part as its water of crystallization, and since those 1½ grains of ferruginous ochre do not belong to the composition of the ore, the constituent parts of the muriated ore of copper may be said to be in the 100 as follows:

Oxide of copper,	73.
Muriatic acid,	10.1
Water of crystallization,	16.9
	* 100.0."

* Essays, ii. 158.

Phosphate of copper.—The following is the method of analysis adopted by Klaproth, in the examination of this ore.

" 1. Because this ore is very much intermixed with its quartzose matrix, I pulverized a portion of it, previously freed as much as possible from the stony matter, and ascertained the weight of quartz still united with it, by solution in nitric acid. The quartz amounted to 16 parts in 100 of the purified ore.

" On this consideration, I weighed 116 grains of the powdered ore, and poured nitric acid upon it. The mixture became of itself moderately warm. When the solution, assisted by a little heat, was thoroughly brought about, and by means of filtration freed from the undissolved quartzy matrix, it showed by its pure sky-blue colour, that it contained no iron.

" 2. After the small portion of the predominant acid had been saturated with potash, I added to the solution dissolved acetate of lead, until no farther precipitation took place. The precipitate was at first drenched for a while with weak acetic acid, then elixiviated with water, and at last perfectly dried in a low heat. It weighed 138 grains.

" That this precipitate was a combination of lead with phosphoric acid, of this I had myself assured by a previous experiment, made with another portion of the same fossil. It exhibited the phenomenon, which is peculiar to phosphated lead; namely, that under the blow-pipe it runs into a pearl, which in the very moment of fixation, rapidly assumes a garnet-like form with shining surfaces.

" Upon another portion of that precipitate, half its weight of sulphuric acid, sufficiently weakened with water, was poured and digested with it. The clear fluid, which had been filtered off from the generated sulphate of lead, and contained free phosphoric acid, was first half saturated with soda, and upon this perfectly neutralized with ammonia. By crystallization, it yielded microcosmic salt, or phosphate of soda and ammonia.

" 3. In order to discover the proportion of the phosphoric acid combined with those 138 grains of the precipitate mentioned before, I proceeded to the following experiment.

" I burned pure phosphorus under a large glass-bell, dissolved the obtained dry phosphoric acid in water, passed it through the filter, and reduced it by evaporation, in a sand heat, to a smaller volume. When towards the end of this process, flames of phosphorated hydrogen gas appeared, I added nitric acid by drops till no longer any red vapours were disengaged.

" Of this perfectly oxygenated unctuous liquid phosphoric acid, I diluted 100 grains with water, and neutralized the liquor with finely powdered white marble; of which 324 grains were employed. The mixture was evaporated to dryness, and the dry mass kept in a moderate red heat for half an hour. This ignited phosphate of lime weighed 256½ grains. In the 324 grains of marble employed in this experiment, the portion of lime, or pure calcareous earth, amounts to 178.20 grains, which if subtracted from the above 256.50 grains, determine the quantity of the phosphoric acid ingredient in that calcareous phosphate to be 78.30 grains.

" From these data, taken together, it now was rendered evident, that in those 138 grains of phosphated lead, which have been produced by the combination of lead with the phosphoric acid, constituting a component principle of the portion of the ore examined,—the concrete phosphoric acid amounts to 30.95 grains.

" 4. The remaining part of the solution, which yet contained the cupreous part of the ore, was first treated with sulphate of soda, to separate the small portion of lead it still held dissolved from a slight excess of acetated lead added in the process (2.). Which done, it was mixed with a little of uncombined sulphuric acid, and a piece of polished iron put into it to precipitate the copper, which I found to weigh 54.50 grains. But as this metal is contained in the ore in an oxidated state, which requires 25 per cent. of oxygen; there must 68.13 grains be reckoned for the oxide of copper.

Copper.

"One hundred grains of this phosphated ore of copper, therefore, consist of,

Oxide of copper.	68.13
Phosphoric acid,	30.95
	* 99.08."

* Ibid. ii. 162.

Arseniate of copper, or *needle-shaped copper ore*.—This ore was examined by Klaproth, according to the following process.

"1. Under the blow-pipe, upon charcoal, this ore detonates, emits a white arsenical smoke, and runs into small reddish-gray globules, which, when again fluxed with borax, yield a pure regulus of copper.

"2. A pure, massive specimen of this ore, weighing 50 grains, was kept in a porcelain crucible, during 15 minutes, in a moderate red heat. Its figure was not altered by the fire: but its dark olive colour was changed into a bright grass green, inclining to that of the siskin. Its weight was diminished by 1¼ grain.

"3. Nitric acid dissolves it quietly in the cold, and the solution possesses an undefiled blue colour. By the addition of nitrated silver, the mixture is not in the least rendered turbid. Acetate of barytes produces a precipitate which entirely disappears upon dilution with water. The affusion of dissolved acetate of lead, forms with this solution a white precipitate, which upon the charcoal emits arsenical vapours, and is reduced to metallic lead, when combined with an excess of ammonia, the precipitate falling down at first, is directly redissolved, no cloudiness left behind, and the deep-blue colour is restored to the liquor.

"4. Also by the acetic acid this ore is gradually dissolved. Upon the evaporation of the solvent, a dark-green salt of a dendritical form remains behind.

"5. One hundred grains of the acicular olive copper ore, which had previously been freed, by means of elutriation, from the admixed reddish iron ochre, soon dissolved in nitric acid, and without the application of heat. The solution, being accurately neutralized with carbonated potash, was combined with dissolved acetate of lead, until all precipitation ceased. The obtained precipitate, when edulcorated and dried in a raised temperature, weighed 133½ grains.

"6. To be more convinced that this precipitate was an arseniated lead, I drenched it with water, and digested it with half its weight of sulphuric acid. The liquor, separated by filtration, contained uncombined arsenic acid. I neutralized it with soda, and treated part of it with a solution of nitrated silver. This produced a copious precipitate of arseniated silver, which possessed the brick-red colour peculiar to it, emitted arsenical vapours upon the charcoal, and was readily reduced to pure silver. The remaining part of the solution, when mixed with liquid nitrate of iron, afforded the common whitish precipitate of arseniated iron.

"Now in order to ascertain, by means of a comparative experiment, the proportion of the acid of arsenic combined with the 133½ grains of the above precipitate (1.), I dissolved in water 100 grains of solid arsenical acid, and added to it a solution of acetated lead in small portions so long as any precipitate would appear. The arseniated lead then obtained weighed 297 grains after edulcoration and drying in a warm place. Hence it followed, that the quantity of concreted acid of arsenic combined with those 133½ grains of the precipitate, which the acid of arsenic contained in the ore had produced, must be estimated at 45 grains.

Copper.

"And to be more assured that all the arsenical acid had been separated from the nitric solution of the ore, I added a little more of acetated lead than would have been absolutely requisite. This was afterwards again precipitated as sulphate of lead, by adding sulphated soda, and filtered off. To the solution, thus freed from the last precipitate, I added uncombined sulphuric acid, and precipitated the copper, now disengaged from its mineralizing acid, by means of a polished piece of iron, in the metallic state. Thus I obtained of it 40½ grains.

"But since in the composition of the olive copper ore the copper is contained in the state of an oxide, it yet remained to discover the proportion of oxygen. To attain this end, I dissolved 200 grains of pure copper in nitric acid, diluted the solution with a sufficient quantity of water, and again precipitated the metal with a lixivium of caustic potash. The precipitate had a light blue colour; but after the mixture had stood a couple of days in a moderately warm place, that blue colour was changed into a brown. When separated by filtration, washed with a large quantity of water, and desiccated in a low heat, this precipitate amounted to 269 grains. Upon ignition it weighed only 250 grains, and appeared in the form of a very subtle, fully-black powder.

"Therefore, because according to this experiment, copper acquires an increase of 25 per cent. of weight by combining with oxygen, it is obvious, that for the above 40½ grains of metallic copper, we must put in the account 50.62 grains of oxidated copper.

"In consequence of this decomposition, 100 parts of the olive copper ore contain,

Oxid of copper,	-	50.62
Acid of arsenic,	-	45.
Water of crystallization,		3.50
		* 99.12."

* Ibid. ii. 150.

SECT. II. *Of the Reduction of the Ores of Copper.*

The processes employed for the reduction of copper ores in the large way are extremely simple. It scarcely ever happens, it has been remarked, that the same order in conducting the different reducing processes, even in cases where the quality of the ore is found to be the same, is observed at two works. The same remark, however, might probably be made with regard to other manufactories, where the same practical management being long established, and attended with ordinary success, its inconveniences or advantages are rarely investigated, with regard to the abridgement of labour, or the diminution of expence. We shall now describe the processes for the reduction of copper ores, which are followed in different places, by which our readers, who are interested in the subject, will be enabled to appreciate the advantages of each, or to suggest improvements of which they are susceptible; and with this view, we shall describe the operations for reducing copper ores which are followed in Cornwall, and in Anglesea.

Method

Copper.

Method of reducing copper ores in Cornwall.—The ore is first broken to pieces, of the size of a hazel nut. This operation is known by the name of *cobbing*. The richer pieces of ore are then picked out by the hand. The next operation is roasting, which is performed in large reverberatory furnaces, 16 feet long, and 14 feet broad. The bottom of the furnace is composed of fire bricks, covered with sand, two feet thick. This sand becomes a semivitrified mass by the intense heat. The height of the chimney is from 40 to 50 feet, the draught of which is so strong, that the sulphur and arsenic, separated during the roasting, are carried almost entirely through it. The ore is introduced through a kind of funnel, and spread to the thickness of a foot over the bottom of the furnace. The fuel is placed at the anterior part of the furnace, so that the flame must pass over the surface of the ore as it is directed by the current of air towards the chimney. The ore is roasted in this furnace with a dull red heat for 12 hours, and is frequently stirred with an iron rake, to expose fresh surfaces to the flame.

The ore being sufficiently roasted, is carried to another furnace, nine feet long by six wide, where it is exposed to a fusing heat, without addition, except that of a little calcareous sand, when the slag does not rise freely. It is raked out at the end of every four hours, when it is of the consistence of soft dough, and is introduced into oblong moulds, a little water being sprinkled upon it, to make it sink down. The slag being raked off, a fresh quantity of calcined ore is introduced into the furnace, and the copper is tapped off by a hole in its side, which had been stopped up with wet clay mixed with one-fourth part of new coal, which prevents the clay from becoming so hard as to render it difficult to open the hole by means of an iron pick. As the rough copper flows from the furnace, it is conducted by a gutter into a large bucket, suspended by chains in a well, through which a stream of water is passing. The metal, as it falls into the water, is granulated, without explosion or danger, and is afterwards taken out by raising the bucket.

But in this state the copper is very impure, being quite brittle, and mixed with arsenic and sulphur, which can only be separated by other processes. For this purpose it is again melted, and granulated two or three times. Each time a slag is thrown up in the furnace; but as it contains some copper, it is not, like the first slag, rejected, but worked over and over again with new charges of calcined ore. The nature of the ore must determine the number of fusions and granulations. After the granulation, the mass is melted and cast into pigs, which have a blistered appearance on the surface. These are again broken up, and melted and roasted several times, by which the metal becomes purer, and is then cast into iron moulds, after which it is carried to the refining furnace; and being again melted with the addition of some charcoal, it is brought to such a degree of purity as to bear the hammer, and be fit for the market. In this way, by repeated calcination and fusion, the common ores of copper are freed from arsenic, sulphur, and earthy matters, and brought to the metallic state. Here it is proper to add, that where there is variety of ores, no small degree of judgment is requisite in sorting and distributing them for the furnace, that the more fusible ores being mixed with such as are more refractory, will render the poorer ores, by the addition of a portion of the richer, worth the working.

Copper.

Method of reducing copper ores in Anglesea.—The ore, which is the sulphuret of copper, is broken into small pieces, and exposed to heat in a kiln, which is close covered. A little fire is applied to the mass of ore in different places, by which the whole is gradually kindled. The kiln is furnished with flues, which open into a long, close, pent-house gallery, for the purpose of collecting the sulphur, which rises in the state of vapour to the top of the kiln, passes through the flues into the long gallery, where it is slowly condensed, is afterwards taken out, and farther prepared for sale. The mass of ore, after it is once kindled, burns of itself for about six months, and in this time the sulphur chamber is four times cleared out. The improved sulphur chambers are constructed in the form of lime kilns, having the ore at the bottom, and the sulphur subliming at the top. The richer part of the roasted ore is exported without being subjected to any other preparation, but the poorest part is melted on the spot, and contains, besides a great deal of sulphur, many other impurities. The smelting houses consist of a range of large reverberatory furnaces, having chimneys above 40 feet high, thus producing a very strong current of air. Thirty one of these furnaces are arranged side by side under the same roof. The fuel, which is coal, is burnt on a grate at the anterior part of the furnace, and the flame is carried over the ore placed on the bottom of it, by the draught of air. Twelve hundred weight of roasted ore is introduced into the furnace, mixed with a small portion of coal dust. Here the ore is melted, and brought to an impure regulus, and when it is sufficiently fused, it is drawn off into earthen moulds. Each charge of the furnace is worked off in about five hours, and yields about half a hundred weight of rough copper, which after being farther purified, affords about 50 per cent. of pure metal.

In reducing copper ores at Neusol in Hungary, lead is employed in the refining part of the process. The rough copper is spread out on the rough bed of a furnace, and after being six hours in fusion, a quantity of lead, in the proportion of from six to eight per cent. of the copper, is thrown in. This immediately begins to vitrify, and form a thick scoria, along with the impurities of the copper. The scoriæ are successively removed, till the whole is separated, and the copper is purified. The scoriæ retain a portion of the copper, and are employed in a future operation. The process continues from ten to twelve hours, with fifty quintals of raw copper.

Some of the fine copper ores contain such a proportion of silver as to render it worth while to extract the metal. In the different roastings and fusions which are employed to bring the copper to a state of purity, the silver always remains combined with it, so that it must be separated by another process. The method of separating silver from copper has been already described, in treating of the reduction of the ores of silver.

The springs which are found in copper mines, or flow from rocks which afford copper ores, are often so strongly impregnated with blue vitriol or native sulphate of copper, as to yield a considerable quantity of this metal. It is obtained by the following process. Large, square open pits, are formed of rammed clay, two or

Iron.

three feet deep. Into these pits the vitriol water is pumped; a quantity of refuse iron is thrown in, which being allowed to remain for a considerable time, the iron is dissolved by its stronger affinity for the acid, and the copper being separated, is precipitated in the form of brown mud. After the water appears to be exhausted of the copper, the oxide of copper collected at the bottom is raked out, and being dried in the sun, may be reduced in the usual way. This material which is the richest employed in obtaining metallic copper, yielding fifty per cent. although contaminated with some iron and clay, is rarely smelted, excepting along with the poorer ores, some of which do not afford more than five per cent. of pure metal.

The plates of copper of a fine red colour, usually known by the name of *rosette copper*, are made by a particular management. When the metal is found to be in a state of sufficient purity, the surface while in fusion is well scummed, and allowed to cool till it is just ready to fix. At this time the workman brushes it over with a wet broom, by which the surface is immediately fixed, and a thin plate is separated from the metal below, which is still in a fluid state. The plate thus produced is taken off and thrown into water, where it becomes of a high red colour. The same operation is repeated and continued successively till the whole of the fluid metal is converted into thin irregular plates of the above description.

Chap. VI. *Of the Ores of Iron.*

The ores of iron, which present a considerable variety, are reduced, on account of the refractory nature of this metal, with no small difficulty. The most powerful agents must be employed for this purpose. And as the construction of furnaces is a matter of the greatest importance in the smelting of iron ores, we were led, when treating of that subject, to enter into a pretty full account of the processes themselves; to this account the reader is referred for information on the methods followed in the reduction of these ores. The present chapter therefore will be only occupied in giving an abridged view of their analysis.

Sect. I. *Of the Analysis of Iron Ores.*

Native Iron.—In analysing this ore, it may be dissolved in diluted nitric acid; the lead may be separated by adding sulphate of soda, thus forming an insoluble sulphate of lead; the oxides of iron and copper may be precipitated by means of caustic fixed alkali at a boiling heat; the addition of caustic ammonia will dissolve the copper, and the iron will remain behind.

Pyrites.—Iron pyrites is either magnetical, or is destitute of this property. When the ore is magnetical, it may be either proper magnetical pyrites, or common pyrites with a mixture of magnetic iron, either in the metallic state, or in that of black oxide. If the magnetism be owing to black oxide mixed with common pyrites, no hydrogen gas will be produced by digesting it in muriatic acid; and if metallic iron and pyrites be combined together, the gas obtained will be hydrogen gas: but if the ore examined be magnetic pyrites, the gas evolved by muriatic acid will be sulphurated hydrogen. The following analysis is applicable to both species of pyrites. 1. After reducing the pyrites to a very fine powder, let it be digested in nitric acid of moderate strength, and boiled almost to dryness; then add a fresh portion of acid, and repeat this process till the whole sulphur is converted into sulphuric acid. 2. Pour off the liquor, edulcorate the undissolved residue, and add the washings to the liquor. 3. Add to this carbonate of soda to a slight excess, and separate the precipitate, if any take place. 4. After neutralising the residual liquor by a little nitrous acid, it may be decomposed by muriate of barytes, which is to be added while any precipitate takes place. A hundred parts of this precipitate indicate 14.5 of sulphur in the ore. 5. The insoluble residue (2.) is next to be digested with caustic soda, and being evaporated to dryness and slightly ignited, the precipitate (3.) is to be added, and the whole dissolved in muriatic acid, and boiled nearly to dryness. By the affusion of water the silica will be left in the state of a white insoluble powder. 6. Mix the muriatic solution with ammonia in slight excess, and the alumina and oxide of iron will be precipitated together, leaving the lime, if there should be any, in the solution, from which it may be obtained in the state of carbonate, by a mild alkali. 7. The iron and alumina may be separated by boiling in nitric acid, which leaves the metallic oxide untouched, or by digestion in caustic potash or soda, which produces a similar effect.

Magnetic Iron Ore, Specula Iron Ore, and *Red Iron Ore,*—are composed chiefly of oxide of iron, with an accidental quantity of silica and alumina. These ores are with difficulty acted on by acids alone. In conducting the analysis, therefore, 1. The ore is to be reduced to a fine powder, and heated in a silver crucible, with caustic soda in solution. When the whole moisture is evaporated, the remaining matter is to be ignited to a low degree for a few minutes; next dissolve the whole contents of the crucible in diluted muriatic acid; evaporate the solution nearly to dryness, and boil the residue in distilled water, acidulated with a little muriatic acid, and the silica will remain behind undissolved. 2. The solution being considerably reduced by evaporation, add caustic soda to a slight excess, and boil it upon the precipitate which is thus obtained. This precipitate, after being edulcorated, is pure oxide of iron, and being heated with a little wax, it may brought to the state of magnetic oxide, one hundred parts of which indicate seventy-three of metallic iron. In this way the quantity of iron in the ore may be estimated. 3. The alkaline solution contains the alumina, which may be separated by muriate of ammonia, and after being washed and ignited, its quantity may be ascertained.

Black Iron Ore, and Brown Iron Ore.—Besides the ingredients contained in the former species, these ores are combined with a portion of manganese; the precipitate obtained, therefore, is a mixture of the oxides of iron and manganese. These oxides may be separated by dissolving them in muriatic acid, and adding to the hot solution caustic soda, drop by drop, till the liquor becomes colourless, or till the precipitate thrown down at each addition of the alkali begins to be white. In this way the oxide of iron is precipitated, while that of the manganese remains in solution The iron being removed, the oxide of manganese may be obtained, by continuing the addition of soda till no farther precipitate is produced. The two oxides may also be separated by adding

succinate

3

Iron. succinate of soda to the muriatic solution, by which means the iron is precipitated, and the manganese remains in solution.

Sparry Iron Ore.—This ore of iron, which is supposed to contain carbonic acid, the oxides of iron and manganese, lime, magnesia and barytes, in the state of carbonate, with a small portion of silica and alumina, may be examined according to the following analysis. 1. Digest the ore reduced to very fine powder, in muriatic acid, with a little nitric acid: a slight effervescence takes place, and the loss of weight indicates the quantity of carbonic acid driven off. 2. The insoluble portion of the ore, after being twice or thrice digested in muriatic acid, is silica. 3 The muriatic solutions and washings, being mixed together, are to be concentrated by evaporation, and decomposed at a boiling heat, by adding caustic soda in excess. 4. Boil the precipitate and supernatant fluid together for a short time, the alumina only will be dissolved. 5. The insoluble portion is next to be well washed and ignited, and being once abstracted with nitric acid, the lime, barytes, and magnesia, will be dissolved, leaving behind the oxides of iron and manganese. 6. To separate the oxides, digest the mixture with a gentle heat in diluted nitric acid, with the addition of a small bit of sugar; the manganese is dissolved, and the remaining oxide of iron may be brought to the magnetic state, by heating it with wax. 7. The nitrate of manganese may be precipitated by carbonate of soda, and after washing and drying it at a heat below redness, pure carbonate of manganese is obtained, one hundred parts of which indicate fifty-five of metallic manganese. 8. To the nitric solution (5.), a good deal diluted with water, add sulphuric acid as long as any precipitate is formed. The sulphate of barytes thus obtained being removed, the other earths may be thrown down by means of the carbonate of an alkali; they are again dissolved in diluted sulphuric acid, and the sulphates of lime and magnesia thus produced, being precipitated by alcohol, may be separated from each other by cold water. In this way the sulphate of magnesia is dissolved, with only a very inconsiderable quantity of the sulphate of lime.

Argillaceous iron ore, bog iron ore, blue earthy and green earthy iron ores,—are chiefly composed of the oxides of iron and manganese, phosphate of iron, silica, alumina, and lime. The analysis of these ores may be conducted according to the following process. 1. After the ore is reduced to powder, and ignited, abstract it two or three times with nitric acid; pour off the acid, and wash the residue with a small portion of strong nitric acid. 2. Add the acids together, evaporate nearly to dryness, wash the residue with cold water; the phosphate of iron remains behind. 3. Ignite the insoluble residue (1.) with caustic soda, and separate the silica as in a former analysis, by muriatic acid. 4. Mix the nitric and muriatic liquors, boil them with an excess of caustic soda, and the alumina will be dissolved, while the metallic oxides and lime are precipitated. 5. After ignition, abstract the compound precipitate with nitric acid; the lime is now dissolved, and nothing remains but the oxides of iron and manganese, which may be separated according to the preceding analysis.

Arseniate of Iron.—This ore is found to contain oxides of iron and copper, with arsenic acid, besides a portion of silica, and sometimes lime. It was analysed by Mr Chenevix, according to the following process. Being reduced to powder, and subjected to less than a red heat, the water of crystallization is driven off; the residue is next boiled with caustic potash, and the alkaline solution being separated by filtration, is to be neutralized with nitric acid. The addition of nitrate of lead affords a precipitate of arseniate of lead, one hundred parts of which indicate thirty-three of arsenic acid. Muriatic acid is next to be added to the residue, which is insoluble in potash; the iron and copper are thus dissolved, and the silica remains behind. By supersaturating the muriatic solution with ammonia, the oxide of iron will be precipitated, and the oxide of copper will remain in solution by the alkali.

But, for practical purposes, we shall give a short view of the simpler methods of assaying the ores of iron, which are chiefly employed in manufacture, with the view of ascertaining the quantity of metal to be obtained from them, when treated in the large way. Among the older metallurgists it was usual to employ active saline fluxes in assaying the ores of iron; but as the metallic part of the ore can only be brought into fusion at a very high temperature, the same degree of heat effects the vitrification of the earthy matters, when aided by lime and bottle glass, so that the use of borax, or alkaline salts, which are more expensive, may be dispensed with.

To assay the richer varieties of magnetic iron ore, particularly iron sand, reduce them to a fine powder, add one-twelfth of charcoal, or double the quantity of fine saw dust, and expose the mixture in a covered crucible for an hour to the heat of a powerful wind furnace. After this the iron will be found at the bottom of the crucible, in the form of an irregular button, and covered with a small portion of cellular scoriæ. This process will be sufficient where the quantity of earthy matter is small; but as the common magnetic iron ore contains a considerable portion of silica, a flux of the following materials may be necessary. For every eight parts of ore take eight of bottle glass, six of limestone or chalk, and one of charcoal; mix the whole carefully together with the ore, and expose the mixture to heat as in the former case. If the operation have succeeded, a button of iron will be found at the bottom of the crucible, covered by a compact, vitreous, greenish slag.

As the specular iron ore generally contains a portion of sulphur, from the admixture of pyrites, it must be roasted at a moderate red heat, till the sulphureous odour is no longer perceptible; then to eight parts of the ore, add eight of bottle glass, six of chalk, and one twelfth of charcoal, and treat the mixture as before. The red, brown, and black iron ores, may be assayed in the same way.

Sparry iron ore may be assayed without roasting, by reducing it to powder, and placing it in a crucible lined with a mixture of charcoal and clay, and then covering it with about one-fourth of its weight of calcined borax.

In assaying argillaceous and bog ores of iron, they are first to be roasted, and then mixed with eight parts of bottle glass, seven of chalk, and one and a half of charcoal, to eight parts of ore, and subjected to fusion in an unlined crucible. It is scarcely necessary to observe, that the proportion of chalk may be diminished in treating

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ing those varieties of ore which contain calcareous earth in considerable quantities.

Sect. II. *Of the Reduction of the Ores of Iron.*

In treating of the construction of furnaces, the proper form and management of which are of the utmost importance in extracting the metal from the ores of iron, we were led to enter pretty fully into the nature and effects of the smelting process, or the method of reducing iron ores. We shall not, therefore, resume the subject in this place. See Furnace.

Chap. VII. *Of Lead.*

In the present chapter we shall first give an account of the most improved methods of analysing the ores of lead; and secondly, treat of the best methods of reducing or smelting these ores.

Sect. I. *Of the Analysis of Lead Ores.*

The analysis of the ores of lead is less difficult than that of the other metals of which we have just now treated; and when accuracy is wanted, the humid way of analysis is to be preferred. The method of separating lead from silver has been already noticed, as well as that by which it is separated from iron and copper. The same process as that employed for separating iron and copper from lead, may be followed with regard to the separation of lead from tin, cobalt, and zinc. We shall now give an account of the analysis of particular lead ores.

Galena, or *sulphuret of lead*.—This species, which is the most common ore of lead, was analysed by Vauquelin, by the following process*. 1. Three hundred parts of the ore, reduced to powder, were roasted; and lost, during the process, twelve per cent. 2. Three hundred parts of the same ore were heated with nitric acid very much diluted; a strong odour of sulphurated hydrogen was perceived, and the solution of the lead being completed and filtered, there remained on the filter pure silica, which being heated to redness and cooled, weighed fifty grains, or 16.67 parts per cent. 3. The solution of lead in nitric acid being decomposed by means of sulphate of soda, and the sulphate of lead precipitated being washed and dried, weighed 250 grains, or 63.1 of metallic lead per cent. 4. After the sulphate of lead was separated, ammonia was added, and a precipitate of oxide of iron was obtained, which being subjected to a red heat, weighed ten grains, or was equal to 3.33 per cent. 5. Carbonate of potash being added to the residual liquor, threw down nine grains of carbonate of lime, which is equal to three per cent. The sulphuret of lead thus analyzed, afforded in one hundred parts,

* *Jour. des Mines*, N° lxviii. p. 157.

Sulphur,	12.
Silica,	16.67
Metallic lead,	63.1
Oxide of iron,	3.33
Carbonate of lime,	3.
Loss,	1.9
	100.00

To assay galena in the dry way, it is to be mixed after roasting with three times its weight of black flux, covered with salt, and melted. A button of lead will be found at the bottom of the crucible, but the silver and other metals which existed in the ore, are still combined with the metallic lead.

Sulphuret of lead, antimony and copper.—An ore of this kind was analysed by Mr Hatchett, by the following process. Two hundred grains of the ore were heated in a matrass, with two ounces of muriatic acid, and nitric acid was very slowly added, till the whole exhibited a moderate effervescence. Being gently heated for an hour, the solution assumed a green colour, and a quantity of sulphur which floated on the surface, being collected, digested separately with a little muriatic acid, and washed and dried, weighed thirty-four grains; and as it burnt entirely away without any residuum, in a red earthen cup, it was perfectly pure. The solution with the muriatic acid, in which the sulphur had been washed, was first boiled, and afterwards mixed with six pints of boiling distilled water, to which it communicated a milky appearance. It was filtered while hot, and the filter washed with another portion of boiling water. The white precipitate, which was oxide of antimony, was dried in a sand bath, and weighed sixty-three grains. When the liquor with the washings cooled, some crystals of muriate of lead were deposited. The liquor was afterwards evaporated nearly to dryness, and a few drops of sulphuric acid were added, to separate the lead which remained in solution. The residue being again dissolved in boiling water, was entirely decomposed by sulphate of soda, and the sulphate of lead thus obtained being added to the former portion, was washed and dried on a sand bath. It weighed. 120 grains.

The liquor, which was now bluish green, assumed a deep blue colour by the addition of ammonia; a small portion of the oxide of iron was separated, which, when dried and heated with wax, became magnetic, and amounted to 2.4 grains. The liquor, after being evaporated nearly to dryness, was boiled with a strong solution of potash, till it was nearly dry, and the residue being washed with water, a black oxide of copper remained; which, after being dried, weighed thirty-two grains.

White lead ore, or *carbonate of lead*.—The white tabular lead ore, from Leadhills in Scotland, was analysed by Klaproth, according to the following process.

"1. One hundred grains of it, in pure specimens, and previously triturated to a powder, were by small portions introduced into a mixture of 200 of nitric acid with 300 grains of water, and put in equilibrium upon the balance. The ore dissolved readily, and with a strong effervescence, without leaving any residue. By the carbonic acid that escaped, there was a loss of 16 grains of weight.

"2. The solution, which was clear and colourless, was diluted with water, and a cylinder of zinc put into it. After 24 hours, the whole of the lead had shot into beautiful metallic laminæ, which collected, washed, and both quickly and carefully dried, to the end that no oxidation might take place, afforded 77 grains of lead in the reguline state, which correspond with 82 grains of oxidated lead.

"Consequently, the constituent parts of this tabular and

Lead.

and carbonated white lead ore, bear to each other the following proportion:

Oxide of lead,	-	82.
Carbonic acid,	-	16.
Water,	- - - -	2.
		† 100."

† Essays, ii. 132.

Green lead ore, or *phosphate of lead*.—The following is an example of the method of analysing this species of ore, adopted by Klaproth.

"1. An hundred grains of this ore, in very pure specimens, left on solution in dilute nitric acid one half grain of the quartzose matrix behind; which I separated and replaced by an equal quantity of pure ore. The colourless solution, treated with nitrate of silver, yielded 10 grains of muriated silver: which indicates 1.54 of concrete muriatic acid, contained in 100 of the ore.

"2. In the next instance, the ingredient lead was separated by means of sulphuric acid. The collected sulphate of lead, after gentle ignition, weighed $104\frac{1}{2}$ grains; for which 77.10. grains of oxidated lead must be put in the account.

"3. When after this the nitric solution had been freed, by nitrated barytes, from the portion of sulphuric acid added to excess, and subsequently treated with ammonia so far, that the acid still predominated, I continued adding a solution of acetated lead, till no more turbidness was effected. The generated phosphate of lead, when collected and exposed to a gentle red heat, proved to weigh 85 grains; and consequently, the proportion of the phosphoric acid must have been 19 grains.

"4. The remaining fluid was mixed with muriatic acid, the mixture evaporated to dryness, and extracted with ardent spirit. The residue, after completely evaporating the spirit, was again dissolved in water, and treated with Prussian alkali. A precipitation of prussiated iron ensued, which indicated the amount of oxide of iron 10 grains.

"From the results of this decomposition it follows, that the constituent parts of green lead ore, and their proportion to each other, are:

Oxide of lead,	-	77.10
Phosphoric acid,	-	19.
Muriatic acid,	- -	1.54
Oxide of iron,	-	0.10
		† 97.74"

† Ibid. ii. 125.

Red lead ore, or *chromate of lead*.—In analysing this ore, Vauquelin adopted the following simple process. Equal weights of the ore reduced to fine powder, strong muriatic acid, and distilled water, were digested together at a moderate temperature, and stirred from time to time. The chromate of lead is thus decomposed, and converted, for the most part, to muriate of lead, which is of a white colour. When the acid has ceased to act, pour off the liquor, add fresh muriatic acid, diluted as before with an equal quantity of water, and to the amount of about one fourth of the former quantity, and digest till the whole of the orange-coloured particles among the white muriate disappear. This liquor is to be added to the former, along with the washings; the whole is to be heated, and placed in a cool place for a few days, that the small portion of muriate of lead which it holds in solution, may be deposited; and this being removed, add very gradually oxide of silver, precipitated from its solution in nitric acid by caustic potash, till the last portions assume a red purple colour. In this way the whole of the muriatic acid is separated, and the liquors contain only chromic acid, which is deposited by slow evaporation in the form of small, prismatic, ruby red crystals. The quantity of muriate of lead obtained by this process being ascertained, will shew the quantity of metallic lead contained in the ore.

Lead.

Yellow lead ore, or *molybdate of lead*.—Klaproth analysed this ore in the following manner.

"1. A hundred grains of the crystals were carefully freed from the adhering calcareous earth and ochre of iron, and then finely pulverized. They were then dissolved in muriatic acid, assisted by heat, alternately affusing upon them the acid, and a large quantity of water. In this instance a trace of siliceous earth, though scarcely discernible, appeared.

"2. The greatest part of muriate of lead, generated in the process, was deposited in fine needles, even before the solution had completely grown cold. The supernatant clear fluid was then poured off, reduced to a smaller volume by evaporation, and freed from the muriated lead, which still separated. The muriated metal, collected with care, and briskly desiccated, weighed $74\frac{1}{2}$ grains. By dissolving it in hot water, and steeping into the solution a polished piece of iron, the lead precipitated upon this last in fine lamellæ, and in the metallic state.

"3. But in order to find more accurately what proportion this muriated lead might bear to pure oxide of lead, I made the following experiment.

"Two hundred grains of lead, cut into shreds, were dissolved in 300 grains of nitric acid, diluted with 10 ounces of water, and, with the assistance of digestion, in a boiling heat. The solution was then divided into two parts.

"*a*. Into one half I dropped muriated acid, as long as it produced any turbidness; evaporating afterwards the mixture to the most perfect dryness of the residue. The muriate of lead here produced weighed 133 grains.

"*b*. From the second half of the nitric solution I precipitated the oxide of lead by dissolved caustic potash. This oxide, when edulcorated and briskly dried till it began to turn yellowish, amounted to 115 grains.

"From this it followed that those $74\frac{1}{2}$ grains of muriated lead, obtained from 100 grains of the yellow molybdate of lead (2.) are equal to 64.42 grains of pure oxide of lead.

"4. The concentrated muriatic solution of molybdena, which had a blue colour, was mixed with nitric acid, and lodged in a sand bath for farther evaporation. Being thus circumstanced, it was again divested of its blue colour, and a yellow oxide of molybdena separated. But when the evaporation had been carried on to complete dryness, I collected and weighed the remaining lemon-yellow oxide of molybdena; and found it amount to $34\frac{1}{4}$ grains.

"Wherefore, one hundred parts of the purest crystals of the yellow lead ore, from Carinthia, contain,

Oxide

Lead.

Oxide of lead,	64.42
Oxide of molybdena,	34.25
	* 98.67."

* Ibid. i. 358.

Sulphate of lead.—This ore of lead was analysed by Klaproth according to the following process.

"1. One hundred grains of tabular sulphate of lead from Wanlockhead, in select pure specimens, lost $2\frac{1}{4}$ grains, by being heated in a covered crucible. When finely pulverized and ignited in a platina crucible with 400 grains of carbonate of potash, they yielded a brownish yellow, moderately concrete mass. Upon this substance, previously triturated, water was affused and heat applied to promote the solution of the soluble parts. As in the case of the preceding fossil, so in this, an oxide of lead deposited from the liquor, which, when washed, dried, and moderately ignited, weighed $70\frac{1}{2}$ grains. Diluted nitric-acid took the whole of it up, without the assistance of heat, and afforded a clear solution, from which the lead has been precipitated in the reguline state, by means of zinc. The metallic lead, thus obtained, when collected, washed and quickly dried, amounted to $65\frac{1}{2}$ grains.

"2. In order to ascertain the quantity of sulphuric acid contained in the alkaline solution, it was combined with nitric acid added to super-saturation in some degree, and, in the next instance, treated with acetate of barytes. By this management sulphate of barytes was formed and precipitated, to the amount of 76 grains, after being heated to redness, which indicates $25\frac{1}{4}$ grains of concrete sulphuric acid.

"According to this decomposition, an hundred parts of this tabular sulphate of lead consist of,

Oxide of lead,	70.50
Sulphuric acid,	25.75
Water of crystallization,	2.25
	†98.50."

† Ibid. ii. 130.

Sect. II. *Of the Reduction of the Ores of Lead.*

Galena is by far the most abundant ore of lead, and indeed almost the only ore which is subjected to the process of reduction. The treatment of this ore of lead in this way is very simple. The first object in dressing the ore, is to separate the extraneous matters or impurities, such as iron pyrites, blende, calcareous spar, quartz, &c. The purer part of the ore is broken to pieces about the size of a hazel nut, and washed from any earthy matters which adhere to it, and then it is ready to be smelted. A ton, or a greater quantity, of the ore, is spread on the floor of a common reverberatory furnace with a low arch, and with the flame of pit coal it is quickly brought to a red heat; being, during this time, occasionally stirred with iron rakes, to expose fresh surfaces to the action of the heat. When it begins to assume the consistence of paste, the heat is lowered, and kept at a dull red, till the whole of the sulphur is nearly driven off; when the heat is increased, and the ore brought to perfect fusion. The mass consists of two fluids the upper being a vitreous slag, and the lower metallic lead. The fire is now damped, and a few spadefuls of quicklime thrown in, by which the scoriæ become suddenly solid, and are removed to the side of the furnace. The tap hole is now opened, and the lead runs into moulds, in which oblong masses or pigs, about 60 pounds each, are formed. After the lead has run out of the furnace, the hole is again closed, the scoriæ are replaced in the bed; and the heat being raised to a glowing red, they are soon melted. The greater part of the lead separates from the slag, and collects in a mass at the bottom. The scoriæ become solid with the addition of a little lime, and the lead is let off into the mould. The second scoriæ still contain a portion of lead, from six to eight per cent.; but as it is not worth the expence of extracting, it is thrown away. It is found that the first running of lead is the best; the second, which is obtained from the scoriæ, being considerably harder, on account of a greater proportion of iron combined with it.

The process which is followed, at least in most parts of Scotland, is somewhat different from that now described, particularly in the previous preparation of the ore. The masses of ore, as it is brought from the mine, being separated from any adhering impurities, are reduced to small pieces, well washed, and then pulverised. In this state it is ready for the smelting process, which till of late was usually performed in an open furnace.

In some mining countries there is a considerable proportion of white lead ore mixed with the galena; doubts have been entertained whether it be profitable to retain this ore, even although it contain a large proportion of metal, because in the reverberatory furnace it is vitrified immediately on the appellation of the heat, and acting as a powerful flux, the whole is brought into fusion before the sulphur be entirely separated; so that the proportion of scoriæ in this case is greatly augmented, with very little increase in the produce of lead.

Tin.

Chap. VIII. *Of the Ores of Tin.*

There is no great variety of the ores of tin. It is usually found in the state of oxide, or in that of sulphuret, when it is also combined with copper, and a small proportion of iron.

Sect. I. *Analysis of the Ores of Tin.*

Before treating of the analysis of the ore of tin, we shall first describe a very simple process for assaying it. The ore is first reduced to the consistence of coarse sand, and separated from the stony matters by washing. If it appear, by subjecting a grain or two to the action of the blow-pipe, that it contains arsenic, 200 grains of the ore mixed with a little charcoal, are to be roasted in a calcining test at a low red heat, till the whole of the arsenic is driven off. The residue is withdrawn, mixed with a little pitch and fine saw-dust, introduced into a crucible lined with charcoal, and after a cover is luted on, placed in a large furnace, whose heat is to be raised to a bright red. In about 20 minutes the reduction is completed, the crucible is removed, and a button of metallic tin is found at the bottom, covered with a little scoriæ. But if the ore should contain no arsenic, the previous process of roasting is unnecessary.

Tin-stone.—The best method of analysing the ores of tin, is that contrived by Klaproth, by means of the fixed alkalies, which was conducted according to the following process.

"1.

Tin.

"1. One hundred grains of tin-stone from Alternon, in Cornwall, previously ground to a subtle powder, were mixed in a silver vessel with a lixivium containing 600 grains of caustic potash. This mixture was evaporated to dryness in a sand heat, and then moderately ignited for half an hour. When the gray-white mass, thus obtained, had been softened while yet warm, with boiling water, it left on the filter 11 grains of an undissolved residue.

"2. These 11 grains, again ignited with six times their weight of caustic potash, and dissolved in boiling water, left now only $1\frac{1}{4}$ grain of a fine yellowish-gray powder behind.

"3. The alkaline solution (1. and 2.), which was in some degree colourless, was saturated with muriatic acid. A brilliant white, tender oxide of tin was thrown down, giving to the mixture a milky appearance. This precipitate, re-dissolved by an additional quantity of muriatic acid, was precipitated afresh by means of carbonated soda. When lixiviated and dried in a gentle heat, it acquired the form of bright yellowish transparent lumps, having in their fracture a vitreous lustre.

"4. This precipitate, being finally powdered, soon and entirely dissolved in muriatic acid, assisted by a gentle heat. Into the colourless solution, previously diluted with from two to three parts of water, I put a stick of zinc; and the oxide of tin, thus reduced, gathered around it in delicate dendritic laminæ of a metallic lustre. These, when collected, washed, and fused, under a cover of tallow, in a capsule placed upon charcoal, yielded a button of pure metallic tin, weighing 77 grains.

"5. The above-mentioned residue of $1\frac{1}{4}$ grain, left by the treatment with caustic potash (2.), afforded with muriatic acid a yellowish solution; from which, by means of a little piece of zinc introduced into it, one half grain of tin was still deposited. Prussian alkali, added to the remainder of the solution, produced a small portion of a light-blue precipitate; of which, after subtracting the oxide of tin now combined with it, hardly one-fourth of a grain remained, to be put to the account of the iron contained in the tin-stone, here examined.

"In these experiments, (excepting only a slight indication of silex, amounting to about three-fourths of a grain), no trace has appeared, either of tungstenic oxide, which some mineralogists have supposed to be one of the constituent parts of tin-stone, or of any other fixed substance. Therefore, what is deficient in the sum, to make up the original weight of the fossil analysed, must be ascribed to the loss of oxygen; and thus the constituent parts of pure tin-stone from Alternon are to each other in the following proportion:

Tin,	77.50
Iron,	0.25
Silex,	0.75
Oxygen,	21.50
	100.00*."

* Essays, i. 523.

The analysis of grained tin ore, or wood tin, may be conducted in the same way as the former.

Tin pyrites.—The following is the process which Klaproth adopted in the analysis of this species of tin ore.

"1. Two drams of finely triturated tin pyrites were treated with an aqua regia, composed of one ounce of muriatic and a half ounce of nitric acid. Within 24 hours the greatest part of the metallic portion was dissolved in it, without application of heat; while the sulphur rose up, and floated on the surface of the menstruum. After the mixture had been digested upon it for some time in a low sand heat, I diluted it with water, and filtered it. It left 43 grains of sulphur on the paper, still, however, mixed with metallic particles. When the sulphur had been gently burnt off on a test, there still remained 13 grains; of which eight were dissolved by nitro-muriatic acid. The remaining part was then ignited with a little wax; upon which the magnet attracted one grain of it.—What remained was part of the siliceous matrix, and weighed three grains.

"2. The solution of the metallic portion (1.) was combined with carbonate of potash; and the dirty green precipitate, thus obtained, was re-dissolved in muriatic acid, diluted with three parts of water. Into this fluid a cylinder of pure metallic tin, weighing 217 grains, was immersed. The result was, that the portion of copper contained in the solution, deposited itself on the cylinder of tin; at the same time that the fluid began to lose its green colour, from the bottom upwards; until, after the complete precipitation of the copper in the reguline state, it became quite colourless.

"3. The copper thus obtained weighed 44 grains. By brisk digestion in nitric acid, it dissolved, forming a blue tincture, and left one grain of tin behind, in the character of a white oxide. Thus the portion of pure copper consisted of 43 grains.

"4. The cylinder of tin, employed to precipitate the copper, now weighed 128 grains; so that 89 grains of it had entered into the muriatic solution. From this, by means of a cylinder of zinc, I re-produced the whole of its dissolved tin, which was loosely deposited on the zinc in a tender dendritical form. Upon being assured, that all the tin had been precipitated, I collected it carefully, lixiviated it cleanly, and suffered it to dry. It weighed 130 grains. I made it to melt into grains, having it previously mixed with tallow, and under a cover of charcoal dust, in a small crucible; which done, I separated the powder of the coal by elutriation. Among the washed grains of tin, I observed some black particles of iron, which were attracted by the magnet, and weighed one grain. Deducting this, there remain 129 grains for the weight of the tin. By subtracting again from these last, those 89 grains, which proceeded from the cylinder of tin employed for the precipitation of the copper (2.) there remained 40 grains for the portion of tin contained in the tin pyrites examined. Hence, including that one grain of tin, which had been separated from the solution of the copper (3.), the portion of pure tin contained in this ore amounts to 41 grains. An hundred parts yielded,

Sulphur,	25
Tin,	34
Copper,	36
Iron,	2
Earthy matters,	13
	100*."

* Ibid. i. 527.

Sect.

Tin.

Sect. II. *Of the Reduction of the Ores of Tin.*

Tin stone, or vein tin, as it is called in Cornwall, contains a large proportion of stony matters. It is first broken by hammers into pieces of the size of a hen's egg, when it is ready for the operation of stamping, which is performed in the way already described for the ores of gold, excepting that there are only three stampers. A tin plate about a foot square, and pierced with holes to admit a moderate sized knitting-needle, is inserted in front of the trough, and that surface of the plate with the rough extremities of the holes is on the inside, by which the holes are prevented from being plugged up with the ore. As the ore is reduced to the proper fineness, it passes with the water through the holes into the labyrinth, where it is collected, and after being washed on a wooden table, when it is ready for roasting. In this state it has a considerable proportion of copper and iron pyrites, and is called black tin. After being calcined at a low red heat for several hours, in a large reverberatory furnace, the ore comes out of a bright ochrey red colour, owing to the decomposition and oxidation of some of the metallic substances; but the oxide of tin, when the operation is properly conducted, remains unaltered. The ore is washed a second time, to separate the remaining impurities; and the water which is impregnated with sulphate of copper, is retained and decomposed by means of old iron.

The reduction of the ore is the next step in the process. Seven cwt. of roasted ore, with one fifth of its bulk of small coal, are introduced into a reverberatory furnace, which is about seven feet long, and $3\frac{1}{2}$ wide. No lime, or indeed flux of any kind is required. A brisk heat is kept up for about six hours; the tin sinking down as it is reduced, and covered with black scoriæ. The furnace is now tapt, and the metal flows into a shallow pit. When the whole of the metal has run out, the scoriæ are removed from the furnace, and a fresh charge is made. The metal in the pit throws up a slag, rich in metal, which is immediately returned into the furnace; and after the melted tin has cooled a little, it is taken out with iron ladles, and poured into granite moulds. Each charge affords on an average from four to five cwt. of metal; but as the first scoriæ are not entirely free from metal, they are again stamped and washed, and mixed with a new parcel of roasted ore. The pigs of tin are next put into a small reverberatory furnace; where, without any addition, they are subjected to a very gentle heat; the purest part of the tin melts first, and is drawn off, forming what is called common grained tin; the other part contains some copper, arsenic and iron, which is brought to a state of fusion, and cast into pigs, forming common tin.

Stream tin ore, which is peculiar to Cornwall, is prepared for the furnace by reducing it to powder, and passing it through wire sieves, which have 16 meshes in the square inch. A blast furnace is employed, which is about seven feet high, and is supplied with air from two cylinders washed by an overshot water wheel. The method of managing the furnace, after being fully heated, is the following. Three or four shovels full of ore, and two or three half bushels of charcoal, without any kind of flux, form a charge with which the furnace is fed at short intervals. There is a small channel at the bottom of the furnace, through which the reduced tin is constantly flowing into a pit below, and the slag which accompanies it is removed from time to time, and returned into the furnace. When the pit is full, the melted metal is removed into an iron boiler three feet in diameter, having a small fire under it, to keep the metal in fusion. Two or three large pieces of charcoal are then placed upon the tin, and forced to the bottom by means of an iron instrument resembling a wheel, with a long handle fixed in the axle. This produces a violent ebullition, and a little slag, before mixed with the metal, rises to the surface, and is removed. In a minute or two the metal is tried, as it is called, by taking up a ladleful, and returning it again into the mass; when, if it assume a bright silver-like appearance, and a uniform consistence, the purification is complete. When cool to the proper degree, it is removed into the moulds, where it is formed into pigs of two or three cwt. Stream tin ore yields from 65 to 75 per cent. of the best and purest tin *.

* Aikin's Diction. of Chem. &c. ii.

Bismuth.

Chap. IX. *Of the Ores of Bismuth.*

Bismuth is found in the metallic state, accompanied by native silver, blende, and galena, some other metals, and earthy substances. It is also met with in the state of oxide, and also in the state of sulphuret.

Sect. I. *Of the Analysis of the Ores of Bismuth.*

In conducting the analysis of the ores of bismuth, previous roasting is not requisite. The native bismuth, or oxide of bismuth, dissolves readily in nitrous acid, diluted with about one third of water, and either in the cold, or with a moderate heat; but boiling is necessary for the sulphuret, to precipitate the sulphur, and dissolve the bismuth. The greater part of the nitrate of bismuth may be precipitated from the solution, and separated from the metals with which it is usually alloyed, by adding a large quantity of water. But to separate the bismuth totally, evaporate the clear liquor which remains over the precipitated oxide to a small bulk, so as to retain in solution the nitrates of the other metals. Add muriatic acid by drops, as long as any white cloud is formed. This last precipitate consists of the remaining portion of the oxide of bismuth, mixed with muriate of silver, if the ore examined contain any of that metal. Then add a few drops of strong nitric acid, which dissolves the bismuth, and leaves the silver; and to this portion of the nitrate of bismuth add water, which separates the whole by precipitation. To ascertain whether the solution contains any silver, expose the precipitate by muriatic acid to the light, which will become of a bluish or slatey colour, if any silver has been dissolved; but if not, the pure white colour remains unaltered. As the oxide of bismuth is composed of 81.3 per cent. of metal, and 18.7 of oxygen, the proportion of metal in the ore may be precisely ascertained by weighing it. The other metals held in solution by the nitrous acid, which are chiefly lead, iron, copper and cobalt, may be separated in the usual way.

Sect. II. *Of the Reduction of the Ores of Bismuth.*

The low degree of heat at which bismuth is fusible, renders

Bismuth. renders the reduction of the ores of this metal a very simple process. In the treatment of the native metal, and the oxide, the weight of the ore of black flux is put into a crucible along with it, covered with salt, to about a finger's breadth, and melted for 5 minutes with a brisk fire; when it is cold, the bismuth is found in a clean button. The flux employed by others is one part of borax, and the same quantity of powdered glass, to two of the ore, and the fusion is effected in a crucible lined with charcoal. With the oxide, a little oil, rosin, or charcoal, should also be mixed. Previous roasting is necessary in the treatment of the sulphuret of bismuth, to separate the sulphur; the other part of the treatment is the same with that now described.

But in the large way, the ores of bismuth are reduced merely by heating them along with burning fuel. Sometimes a shallow hole is made in the ground, and filled loosely with pieces of wood and bushes, and after the fire is kindled, the ore reduced to small pieces is thrown in; and sometimes the stump of a hollow pine tree is filled with wood and ore alternately, and set on fire; the bismuth separates from its matrix, and collects in a mass at the bottom.

Chap. X. *Of the Ores of Zinc.*

The ores of zinc are, the native carbonate, or common calamine, the oxide of zinc, and the sulphuret.

Sect. I. *Analysis of the Ores of Zinc.*

On acount of the great volatility of zinc, it cannot be examined in the dry way, or subjected to assay, without particular precaution. In assaying blende, or the sulphuret of zinc, the ore, after being bruised, is to be carefully separated from particles of galena, or other impurities. It is then to be roasted, and the sulphur being driven off, to be reduced to fine powder, mixed with half its weight of charcoal, introduced into an earthen retort, to which a tube is fitted. The retort being exposed to a strong heat in a wind furnace, for three quarters of an hour, is to be gradually cooled, and on breaking it, the zinc is found in the neck, in metallic drops. The object may be accomplished in another way. Prepare the ore as before, and having mixed it with charcoal, let it be stratified in a crucible, with its own weight of copper clippings; and having luted on a perforated cover, subject it for nearly an hour to a low white heat. Allow it to cool, and examine and wash the contents. The globules of brass formed are thus easily separated from the other impurities, and the excess of weight of the brass above the copper, indicates the quantity of zinc given out by the ore.

Blende, or *sulphuret of zinc*.—This ore is found to contain not only zinc and sulphur, but sometimes iron, lead, copper, and arsenic, with silica, alumina, and a portion of water. It may be analyzed by the following process:

1. Introduce into a small coated glass retort, 200 grains of ore reduced to powder, and let it be gently ignited for a quarter of an hour. The fluid collected in the receiver will be found to be water.

2. Digest another portion of ore in repeated quantities of diluted nitric acid, till every thing soluble is taken up; wash the residue; weigh and ignite it; the loss of weight indicates the quantity of sulphur which is burnt off. Zinc.

3. Digest the residue in a little nitro-muriatic acid, till the insoluble portion becomes quite white, which is pure silica.

4. Add to the nitric solution (2.) a few drops of sulphate of soda; evaporate gently, and continue to add sulphate of soda while a precipitate is formed, and after being evaporated nearly to dryness, digest in diluted muriatic acid; the sulphate of lead remains behind.

5. Add together the nitro-muriatic solutions (3, 4.); decompose by carbonate of soda, and digest the precipitate in caustic ammonia; the zinc and copper are thus dissolved.

6. Let the ammoniacal solution (5.) be saturated with muriatic acid; boil it, and add caustic soda, while a precipitate takes place: this is the brown oxide of copper.

7. Oxide of zinc now only remains in the soda solution, which is to be saturated with muriatic acid, and decomposed by carbonate of soda. The precipitate obtained after ignition is oxide of zinc.

8. The residue which was insoluble in ammonia (5.), is to be treated repeatedly with nitric acid, and digested in caustic soda. Oxide of iron, contaminated slightly with arsenic, remains insoluble.

9. Having saturated the soda solution (8.) with nitric acid, add nitrate of lead, till no farther precipitate is formed; the precipitate is arseniate of lead.

10. And to the residual liquor, add first, sulphate of soda, to separate any nitrate of lead that may remain; filter the liquor, decompose it by carbonate of ammonia; the precipitate, washed and ignited, is pure alumina.

Calamine, or *carbonate of zinc*.—The ores of this species contain, besides the carbonate of zinc, the carbonates of lead, iron, and lime. The following is the mode of analysis.

1. The ore reduced to powder is to be dissolved in diluted nitric acid; the loss of weight during the solution indicates the quantity of carbonic acid. Neutralize the solution with caustic soda, evaporate gently, and add from time to time a few drops of sulphate of soda while any precipitate is formed.

2. Having thus cautiously brought it nearly to dryness, digest it in highly rectified alcohol, and afterwards in a little cold water, which will take up every thing but the sulphates of lead and lime.

3. These may then be separated by digestion in sulphuric acid very much diluted, which will take up the sulphate of lime, leaving the sulphate of lead pure.

4. Neutralize the muriatic solution by soda, and evaporate nearly to dryness; then add alcohol to the residue, which will throw down the sulphate of lime with a little sulphate of soda, which latter may then be washed away by a little cold water.

5. The alcoholic solution (2.) after evaporation to dryness, may be digested in caustic ammonia, which will take up the oxide of zinc, and leave behind the oxide of iron.

6. The alkaline solution, after being slightly supersaturated with muriatic acid, is to be decomposed by a perfectly carbonated alkali, by which the zinc is pro-

Zinc.

cured in the state of carbonate; and this, after edulcoration, being dissolved by sulphuric acid, and the solution ignited in a platina crucible, affords dry sulphate of zinc, containing 50 per cent. of oxide of zinc.

7. Thus, all the constituent parts are ascertained except the water: to determine the proportion of this, take a fresh parcel of the ore, weigh it, and then ignite it for half an hour, note the loss of weight, and transfer the residue into muriatic acid; if while it dissolves in this fluid it gives out any gas, let the loss of weight be noted; then add together the losses by ignition and solution; deduct from the sum the known weight of the carbonic acid, and the residue is water.

SECT. II. *Of the Reduction of the Ores of Zinc.*

The ore being reduced to small pieces, and the different impurities being separated, it is next calcined in a reverberatory furnace at a moderate red heat, and if the ore be calamine, the carbonic acid is driven off, and if blende, it is deprived of its sulphur. After this it is washed, and the metallic oxide being separated from the earthy parts, it is dried, and carefully mixed with about one-eighth of its weight of charcoal, by grinding the ingredients together in a mill, and is now ready for the smelting process. This is performed in a circular furnace, in which are fixed six large earthen pots, about four feet high and nearly of the shape of oil jars. An iron tube is inserted into the bottom of each pot, and, passing through the arched floor of the furnace, terminates in a vessel of water placed beneath, while the other end of the tube rises within the crucible to a few inches of the top. The crucibles are then filled with the mixture of the ore and charcoal, to the level of the tube, the cover of each is carefully luted on, and an intense heat is to be kept up for several hours. The zinc, as the process of reduction goes on, rises in the form of vapour to the top of the pot; but as it cannot escape, it descends through the iron tube, passes into the water, and is condensed in small drops. The globules are afterwards fused, and cast into the form of ingots, when it is fit for the market.

But as common zinc contains a little of other metals, as copper, lead, arsenic, iron, and manganese, which impair its quality, these impurities are partially separated by melting the zinc in a crucible, and stirring into it, with a stick or earthen rod, a mixture of sulphur and fat; by the latter the zinc is preserved from oxidation, and the sulphur combines with all the other metals except the zinc, and converting them into sulphurets, they rise to the top in the form of scoriæ, which may be removed. This process is to be repeated as long as any scoriæ appear. The method of purifying zinc proposed by Proust, is simple distillation in an earthen retort. The zinc passes over, and the oxides of the other metals remain behind. But it is supposed that the arsenic or lead cannot be separated in this way.

CHAP. XI. *Of the Ores of Antimony.*

NATIVE antimony is a very rare production; the most common ore of antimony is the sulphuret; but it is also sometimes found in the state of oxide.

Antimony.

SECT. I. *Of the Analysis of the Ores of Antimony.*

Gray ore of antimony, or sulphuret of antimony.—As the sulphurets of antimony are the principal ores of this metal, we shall only describe the process by which the analysis of these ores may be conducted.

1. Five hundred grains being reduced to fine powder, are to be digested with 1500 grains of pure nitric acid of specific gravity 1.25, and 1000 grains of water, for half an hour, at 150° Fahrenheit; then add a quantity of pure water, equal to the rest of the fluid; mix the whole well together, and pour off the liquor as soon as it becomes clear. This consists of the nitrates of silver, lead, and copper, and perhaps a little iron dissolved in an excess of acid. By simple boiling and filtration, the iron is separated in the state of red oxide.

2. Add to the solution muriate of soda, while any precipitate takes place, and let the whole stand till the supernatant liquor becomes clear; the precipitate is pure muriate of silver.

3. The solution (2.) is next to be saturated with potash or soda, and concentrated by evaporation to one-third of its bulk. The addition of caustic ammonia in excess throws down the lead in the state of oxide, and the copper remains in solution.

4. Acidulate slightly the solution (3.) with nitrous acid; add carbonate of potash, by which the green oxide of copper will be precipitated, and being subjected to a low red heat, is reduced to the state of brown oxide, of which 100 parts indicate 85 of metal.

5. The portion of ore (1.) which was insoluble, is next to be digested at a degree of heat below boiling, with successive portions of nitromuriatic acid, composed of nitric acid, as long as any thing is taken up. The different solutions are then mixed, concentrated by evaporation, and poured into a large portion of pure water; a precipitate immediately takes place, which is the white oxide of antimony, which, after being separated and washed, is to be mixed with twice its weight of crude tartar and a little nitre, and then exposed to a full red heat, which in a few minutes reduces it to the metallic state.

6. The solution (4.) contains now a little sulphuric acid and iron, with some earthy matters. By adding nitrate of barytes while any precipitate is produced, the quantity of acid may be ascertained, and then adding caustic potash in excess, which, assisted by a boiling heat, will precipitate the iron, and retain the alumina and silica.

7. The insoluble residue (6.) contains sulphur and earth; it is decomposed by a red heat, the sulphur being dissipated, and the earth remains.

SECT. II. *Of the Reduction of the Ores of Antimony.*

The ore of antimony, which is found in sufficient quantity to be employed in the process of reduction in the large way, is the sulphuret, the analysis of which has now been detailed. The ore being separated from the greater part of the stony matters which adhere to it, is placed on the bed of a reverberatory furnace, and covered with charcoal powder; and being brought to a low red heat, the sulphuret enters into fusion, and the earthy

Antimony. earthy parts floating on the surface, are removed with a rake. The melted part is cast into the form of large cakes, and is the crude antimony of the shops.

The metal is obtained in a state of purity from the crude antimony, or sulphuret, by different processes. The following is recommended as one of the best, and most frequently practised. The sulphuret being reduced to small pieces, is strewed thinly on the floor of a reverberatory furnace, to drive off the sulphur. The heat at first must not exceed that of the melting point of tin, otherwise the antimony will melt. A lambent blue flame is observed over the surface of the ore, which proceeds from the combustion of the sulphur; the metal is deprived of its lustre, and is converted into a grayish oxide. In the course of some hours, by carefully stirring the ore, and cautiously increasing the temperature, as the fusibility diminishes, it at last ceases to give out sulphureous vapours, and can bear a moderate red heat without melting. After the roasting, the ore is removed from the fire, and is found changed into an ash-gray oxide, weighing from 30 to 36 per cent. less than the sulphuret, but it is not yet entirely free from sulphur. To reduce the oxide, mix it with half its weight of crude tartar, and subject to a full red heat in a covered crucible. The oxide is decomposed by the carbonaceous part of the tartar, and the antimony, reduced to the metallic form, is collected at the bottom of the crucible. A small proportion, however, still remains, dissolved by the sulphuret of potash, formed by the alkaline base of the tartar and the sulphur of the oxide. The quantity of metal which is thus obtained in the large way, amounts to 66 or 70 per cent. of the oxide employed. The loss, however, would be greater, if the ore has not been properly roasted.

The reduction is effected also by another process, which is supposed to be more economical. The roasted oxide is mixed with oil or fat, and a little powdered charcoal, and then introduced into a crucible; and as the metal begins to appear, powdered nitre, in the proportion of an ounce to a pound of oxide, is gradually injected, after which the whole mass is brought to thin fusion, affording a pure metal, and in greater proportion than in the usual way.

The only other process which we shall mention, for reducing sulphuret of antimony, is that by means of some of the other metals, for which the sulphur has a greater affinity than for the antimony. Proceeding on this principle, iron, copper, lead, silver, and tin, may be employed in the process; but as iron is not only more effectual, but also cheaper, it is preferred. The antimony obtained by this process, was formerly called *martial regulus*, not only on account of the iron being used in the preparation, but, not improperly, on account of a small portion of that metal which still adheres to it. The proportions recommended are the following: Eight ounces of small iron nails are heated in a crucible almost to whiteness; 16 ounces of crude or roasted sulphuret of antimony, coarsely pounded, are then added: the crucible is covered, and the fire kept up; and in a few minutes, when the whole is melted, three ounces of nitre are to be added: after a slight detonation has taken place, the whole is brought to perfect fusion. It is then put into an iron cone previously heated and greased, and as the mass becomes solid, the sides of the cone are struck, to promote the precipitation of the metal. When cold and weighed, a mass of antimony is obtained, equal to about 20 ounces of the sulphuret employed, covered with alkaline ferruginous scoriæ, from which it is easily separated by a blow of the hammer.

Cobalt. But the metal is not yet entirely free from iron and sulphur; to purify it still farther, therefore, it is to be remelted, two ounces of crude antimony, and three of nitre being added; and when the detonation has ceased, it is poured into a cone, and the metal is separated as before, from the scoriæ. Fuse the metal again; project upon it three ounces of nitre; separate the purified metal from the scoriæ; remelt with a strong heat, projecting gradually three ounces of nitre, and immediately pour it into a cone. About eight ounces of a beautiful stellated regulus, covered with yellowish white scoriæ, are thus obtained.

Chap. XII. *Of the Ores of Cobalt.*

Cobalt exists usually in a state of combination with arsenic and sulphur, or in the state of oxide. Scarcely any of its ores are free from arsenic and iron. Nickel is also sometimes abundantly mixed with the ores of cobalt, and occasionally a little manganese and copper.

Sect. I. *Of the Analysis of the Ores of Cobalt.*

White and gray cobalt ores, consisting chiefly of arsenic and cobalt, may be examined in the dry way, according to the following process, which, however, is not to be considered as very perfect. The ore is to be mixed with charcoal or saw-dust, and roasted to drive off the arsenic. The oxide after calcination is mixed with four times its weight of an equal mixture of carbonate of potash and tartar, and heated intensely, at the temperature which is required for melting cast-iron. A button of metallic cobalt is found beneath the scoriæ, which are always of a deep blue, or nearly black colour, owing to the combination of part of the oxide of cobalt. A hundred grains of this ore, treated by Klaproth according to this process, yielded 44 grains of metallic cobalt; but if the ore contained iron, copper, or nickel, it must have been alloyed with these metals, and perhaps not entirely free from arsenic.

But the analysis may be conducted with more accuracy according to the following process by Tassaert *.

1. With a view to ascertain the quantity of arsenic, he digested 100 parts of cobalt ore with diluted nitric acid. The whole was dissolved in a few hours, and deposited, on cooling, white crystalline grains. By evaporation more crystals were deposited; the whole collected and dried, weighed 56 parts, and, excepting three parts, the whole was sublimed. These 53 parts are oxide of arsenic, and indicate 49 per cent. of metal in the ore.

2. Three hundred parts of the ore digested with four times as much nitric acid, afforded a rose-coloured solution. After partial evaporation, and with the addition of water and heat, a pale-red precipitate (1) was formed, leaving a rose-coloured solution. The solution being boiled with an excess of potash, afforded an oxide of cobalt, which was rose coloured, and then green, and when dried in a red heat, black. The amount was 85 parts.

* Ann. de Chim xxviii. p. 9.

5 3. These

Cobalt.

3. These 85 parts, dissolved in nitro-muriatic acid, gave, with the addition of pure ammonia, a black precipitate, which, excepting a small portion, was again dissolved by an excess of alkali. The undissolved portion treated again with nitro-muriatic acid and ammonia, was reduced to four parts, and appeared to be oxide of iron.

4. The rose-coloured precipitate (2.), which was a mixture of arseniate of cobalt and iron, being decomposed by caustic potash in excess, afforded a precipitate, which weighed, after being dried, 100 parts.

5. The 100 parts (4.) being again dissolved in nitric acid, and the solution being partially evaporated, and then diluted with water, gave a precipitate of 27 parts of oxide of iron, and left a clear solution of cobalt.

6. The nitrate of cobalt (5.) was decomposed by ammonia; and the precipitate redissolved by an excess of the alkali, excepting an insoluble oxide of iron, amounting to 15 parts. The solution was then added to the ammoniated cobalt (3.).

7. The insoluble precipitates of oxide of iron (3. 5. and 6.) were then mixed and examined. With borax they gave a blue glass, indicating a portion of cobalt still combined. They were then dissolved in nitro-muriatic acid, precipitated by ammonia, and the wet precipitate was introduced into acetic acid, which at first dissolved the whole, but by boiling and evaporation nearly to dryness, four times successively, the oxide of iron became insoluble, while the cobalt remained in solution, and as it was more freed from iron, it assumed more of a fine rose colour. The solution of acetate of cobalt was supersaturated with ammonia, and the solution of ammoniated cobalt was added to the different portions of the same, obtained in former experiments. To expel the ammonia, the whole solution was boiled, and, by adding potash, the whole oxide of cobalt, was precipitated, which being washed and dried, amounted to 133 parts. The oxide being reduced in a crucible lined with charcoal, afforded pure metallic cobalt, of specific gravity 8.538.

8. To determine the quantity of sulphur, 100 parts of the ore were separately boiled with 500 of nitric acid, and diluted with water, to separate the whole of the oxide of arsenic that deposited spontaneously. The sulphur was now converted into sulphuric acid; nitrate of barytes was added, and a precipitate of sulphate of barytes was formed, the quantity of which being ascertained, the proportion of sulphur might in this way be estimated.

Sect. II. *Of the Reduction of the Ores of Cobalt.*

As cobalt in the metallic state is not applied to any useful purpose, the reduction of its ores in this view is not an object of manufacture. But as it is extensively employed in the state of oxide, to give a fine blue colour to glass, porcelain, &c. we shall here give a short account of the method of preparing the ores for this purpose. When the oxide of cobalt is simply mixed, after calcination, with a quantity of vitrifiable earth, it is then known by the name of *zaffre*, and it is in the form of a brown, gritty powder; but if it be melted with a quantity of vitrifiable matters, it yields a glass of a very deep blue colour, which being reduced to a fine powder, constitutes the smalt of commerce.

Preparation of zaffre.—This substance is chiefly prepared in the large way, in different parts of Germany, but particularly in Saxony, and the following is the method of its preparation. The furnace employed is somewhat like a baker's oven, and is so constructed, that the flame of wood may be reverberated on all sides. The cobalt ore is placed on the hearth of the furnace, and by the action of the flame soon becomes red hot; a dense arsenical vapour arises, which is conducted through a horizontal wooden square trough or chimney, some times 100 fathoms long. In this chimney the arsenic is chiefly condensed, yet it is said, that some of the vapours, on account of their great volatility, escape. The calcination is continued till the exhalation of vapours nearly ceases: the ore is then reduced to powder, calcined a second time, again ground, and passed through a fine sieve. The powder is then mixed with two parts of powdered flint or quartz, after which it is moistened, and packed into barrels, where it acquires a great degree of hardness. This is the zaffre of commerce, in the state in which it is exported; the exportation of the simple coloured oxide being prohibited under heavy penalties, it is said that the flints are added with a view to conceal the real nature of the substance.

Preparation of Smalt.—This is also sometimes called zaffre, and when reduced to a very fine powder, it is called *azure blue*. It is prepared with about equal parts of calcined cobalt ore, potash, and ground flints. This mixture is first fritted, and afterwards made into glass, in pots like those of the glass-house. Eight or ten hours are required for its fusion. When the blue colour is perfect, the fused matter is taken out with iron ladles, and dropt into cold water, which makes it crack in all directions, so that it is easily reduced to fine powder. This operation is performed in a mill of very hard stone, inclosed in a wooden case. In the preparation of the smalt by the above process, a portion of bismuth, which usually accompanies the ores of cobalt, is found. Above it there is also a mixed alloy of iron, copper, and arsenic.

Chap. XIII. *Of the Ores of Nickel.*

Nickel.

Nickel, as it is found in the state of ore, is usually combined with arsenic and sulphur, copper and iron, or with oxygen, in the form of oxide.

Sect. I. *Of the Analysis of the Ores of Nickel.*

When the ore contains, beside nickel, arsenic, sulphur, copper, and iron, with which it is usually accompanied, cobalt, silver, and bismuth, with some earthy matters, the analysis may be conducted according to the following process.

1. The ore being reduced to an impalpable powder, is to be two or three times digested in nitric acid, considerably diluted, after which every thing soluble will be taken up. During the process, nitrous gas is given out.

2. The insoluble part consists mostly of sulphur and silica, which after being dried, weighed and heated, the sulphur burns off, and the difference of weight before and after ignition, indicates its amount. The residue, after boiling in a little nitrous acid, is pure silica.

3. Saturate the two nitrous solutions (1. and 2.) with pure

Manganese.

pure soda, evaporate considerably, and pour the solution into cold distilled water; the oxide of bismuth is precipitated.

4. Add muriate of soda by drops to the filtered solution, while any precipitate is formed, which is the muriate of silver.

5. Evaporate the solution nearly to dryness, boil it with strong nitric acid while nitrous gas is given out; red oxide of iron is precipitated during the process.

6. Remove the oxide of iron, saturate the liquor with soda, and add nitrate of lead while any precipitate takes place. This is the arseniate of lead, which may be separated by filtration.

7. Decompose the nitrous solution by carbonate of soda: digest the washed precipitate in liquid ammonia; the oxide of iron mixed with alumina, is left behind, and may be separated by caustic fixed alkali.

8. Let the ammoniacal solution be slightly supersaturated with nitric acid, and a polished bar of iron introduced; in this way the copper will be separated: then decompose the liquid by carbonate of soda, and digest the precipitate in ammonia, and the iron employed in separating the copper will be removed.

9. The solution now contains only nickel and cobalt. Let it be evaporated till the excess of ammonia be expelled. This is the case when the vapour ceases to discolour moist turmeric paper. Then add pure potash or soda to the solution largely diluted, while any precipitation takes place. The precipitate is the oxide of nickel. The cobalt now only remaining in the solution, may be separated in the usual way. To reduce the oxide of nickel, mix it with glass of borax and a small quantity of carbonaceous matter, and then subject it in a crucible to the most powerful furnace heat. A button of pure nickel is thus produced.

As the ores of nickel are not very abundant, and as this metal is little employed for purposes of manufacture, the reduction of its ores does not extend beyond chemical analysis, which we have now detailed.

Chap. XIV. *Of the Ores of Manganese.*

Manganese usually exists in the state of oxide, combined with a small proportion of iron, or in the state of carbonate, and sometimes in that of sulphuret.

Sect. I. *Of the Analysis of the Ores of Manganese.*

Radiated gray ore of manganese.—This ore was analysed by Klaproth according to the following process.

"Two hundred grains of the ore, in grossly broken crystals, were heated to a thorough redness in a small coated glass retort, connected with the pneumatic apparatus. The gas collected amounted only to nine grains, upon deducting the common air of the apparatus; but shewed by the lively combustion of an iron wire confined in it, that it was pure oxygen gas.

"2. In the small intermediate hollow glass sphere of the apparatus, a considerable quantity of moisture has condensed, which weighed 14 grains, and was pure water.

"3. The manganese, having sustained that ignition, weighed 181 grains. The external lustre of the crystals was very much diminished, and their gray colour turned blackish.

"One hundred parts of this ore have, consequently, been decomposed into,

Black oxide of manganese	90.50
Water,	7.
Oxygen gas,	2.25
	99.75 "†

† Essays, ii. 245.

As manganese is chiefly employed for economical purposes, in the state of oxide, the reduction of its ores forms no object of manufacture.

Chap. XV. *Of the Ores of Molybdena.*

For an account of the treatment of the ores of molybdena, which exists in the state of sulphuret and in that of oxide only, see Chemistry; see also the analysis of the molybdate of lead, in the chapter on lead, in this article.

Chap. XVI. *Of the Ores of Arsenic.*

Arsenic is found native, when it is alloyed with a small portion of iron, and sometimes also with a little gold or silver; in the state of sulphuret, or in the state of oxide.

Sect. I. *Of the Analysis of the Ores of Arsenic.*

The method of analysing the ores of arsenic by Bergman, has been already given under Arsenic in the article Chemistry, as well as the method of subliming the metal in close vessels, to obtain it in a state of purity. The following is recommended as a successful process for preparing this metal for nice chemical purposes. Mix a quantity of arseniate of potash with about $\frac{1}{8}$ part of charcoal, and let it be sublimed in a close glass vessel, slowly heated to redness. The metallic arsenic thus obtained is in the form of beautiful brilliant crystals.

Sect. II. *Preparation of White Arsenic and Orpiment.*

White arsenic.—In the large way, this is prepared, by roasting the arsenical ores, previously ground to powder, and mixed with charcoal or saw dust, at a low red heat for several hours. The roasted ore is then subjected to a second sublimation, according to the following method; which is practised in Bohemia. The vessels in which the sublimation is performed, are strong square boxes of cast iron furnished with conical heads, which are closely luted with clay. These boxes are arranged in a spacious brick area, which is heated by flues proceeding from two furnaces, placed a little below them. When the impure arsenic has become red hot, it is removed into the boxes by 15 pounds at a time, where it is brought into fusion, and about an hour after begins to sublime into the conical head. When the arsenic ceases to rise, another quantity is introduced into the vessel, and treated in the same way. These additions are continued till about 150 pounds of arsenic have been thus treated in each vessel; a period of about 12 hours is requisite for the sublimation of the whole quantity. When the vessels are cold, the conical head is taken off, and the sublimed arsenic is broken off with hammers, at the same time any impurities that adhere to it are separated, for a second operation.

Orpiment.—

Arsenic.

Orpiment.—This substance is prepared in the same manner, and with the same apparatus, but the arsenic is previously mixed with half its weight of sulphur. In both cases a uniform red heat should be kept up during the operation, so that the materials in the lower vessel may be always in fusion; and when these materials are of any tolerable degree of purity, almost the whole is sublimed.

As the remaining metals have yet been found only in very small quantity, the reduction of their ores is not an object of much importance. A short account of the method of analysing them will be found under CHEMISTRY, and the characters of the ores, with their constituent parts, will be found under MINERALOGY. See also ASSAYING, CHEMISTRY, and DECOMPOSITION CHEMICAL, in the SUPPLEMENT.

For the account of an elaborate analysis of the ores of tellurium, see Klaproth's Essays, ii. 1.

Orellana || Orestes.

ORELLANA, FRANCIS, the first European, as is commonly thought, who discovered the river of the Amazons. In 1539, he embarked near Quito, upon the river Coca, which farther down takes the name of Napo. From this he fell into another large river; and, leaving himself entirely to the direction of the current, he arrived at Cape North, on the coast of Guiana, after sailing nearly 1800 leagues. Orellana perished 10 years after, with three vessels which had been intrusted to him in Spain, without being able to find again the mouth of this river. In sailing down the river, he met with some armed women, against whom an Indian cacique had told him to be on his guard; and he thence named it *the river of the Amazons*.

ORENSE, an ancient town of Spain, in the kingdom of Galicia, with a bishop's see, famous for its hot baths, is seated at the foot of a mountain, on the river Minho, over which there is a handsome bridge of one arch. W. Long. 7. 27. N. Lat. 42. 16.

ORESTES, in *Ancient History*, a son of Agamemnon and Clytemnestra. When his father was cruelly murdered by Clytemnestra and Ægisthus, young Orestes was saved from his mother's dagger by means of his sister Electra, called by Homer *Loadicea*, having been privately conveyed to the house of Strophius, who was king of Phocis, and who had married a sister of Agamemnon. He was tenderly treated by Strophius, who carefully educated him with his son Pylades. The two young princes soon became acquainted, and from their familiarity arose the most inviolable attachment and friendship. When Orestes came to years of discretion, he visited Mycenæ, and avenged his father's death by assassinating his mother Clytemnestra and her adulterer Ægisthus. Various accounts are given of the way in which these murders were committed. After their commission, however, he was acknowledged king of Mycenæ; but being tormented by the Furies, a punishment which the ancients always thought followed parricide, he exiled himself to Argos, where he was still pursued by the vengeful goddesses. Apollo, however, purified him, and he was acquitted by the unanimous opinion of the Areopagites, whom Minerva herself instituted on this occasion, according to the narration of the poet Æschylus, who flatters the Athenians in his tragical story, by representing them as passing judgment even upon the gods themselves. According to Pausanias, Orestes was purified of the murder, not at Delphi, but at Trœzene, where still was seen a large stone at the entrance of Diana's temple, upon which the ceremonies of purification had been performed by nine of the principal citizens of the place. There was also at Megalopolis, in Arcadia, a temple dedicated to the Furies, near which Orestes cut off one of his fingers with his teeth in a fit of insanity. These different traditions are confuted by Euripides, who says that Orestes, after the murder of his mother, consulted the oracle of Apollo at Delphi, where he was informed that nothing could deliver him from the persecutions of the Furies, if he did not bring into Greece Diana's statue, which was in the Taurica Chersonesus, and which, as it is reported by some, had fallen down from heaven. This was an arduous enterprise. The king of Chersonesus always sacrificed on the altars of the goddess all such as entered the borders of his country. Orestes and his friend were therefore both carried before Thoas the king of the place, and they were doomed to be sacrificed. Iphigenia, Orestes's sister, was then priestess of Diana's temple, and it was her office to immolate these strangers. The intelligence that they were Grecians delayed the preparations, and Iphigenia was anxious to learn something about a country which had given her birth. She even interested herself in their misfortunes, and offered to spare the life of one of them, provided he would convey letters to Greece from her hand. This was a difficult trial: never was friendship more truly displayed, according to the words of Ovid, *ex Pont.* 3. *el.* 2.

Ire jubet Pylades carum moriturus Orestem.
Hic negat; inque vicem pugnat uterque mori.

At last, however, Pylades gave way to the pressing intreaties of his friend, and consented to carry the letters of Iphigenia to Greece. These were addressed to Orestes himself; and therefore these circumstances soon led to a discovery of the connections of the priestess with the man whom she was going to immolate. Iphigenia was convinced that he was her brother Orestes; and when the cause of their journey had been explained, she herself resolved with the two friends to fly from Chersonesus, and to carry away the statue of Diana. Their flight was discovered, and Thoas prepared to pursue them; but Minerva interfered, and told him that all had been done by the will and with the approbation of the gods. Some imagine that Orestes came to Cappadocia from Chersonesus, and that there he left the statue of Diana at Comana. Others contradict this tradition; and Pausanias thinks that the statue of Diana Orthia was the same as that which had been carried away from the Chersonesus. Some again suppose that Orestes brought it to Aricia in Italy, where Diana's worship was established. It was after this that Orestes ascended the throne of Argos, where he reigned in perfect security, married Hermione the daughter of Menelaus, and gave his sister to to his friend Pylades. The marriage of Orestes with Hermione is also a matter of dispute among the ancients. All are agreed that she had been promised to the son of Agamemnon; but Menelaus had married her to Neoptolemus the son of Achilles, who had shown himself so truly interested in his cause during the Trojan war. The marriage of Hermione with Neoptolemus displeased Orestes; he remembered that she had been early promised to him; he was therefore determined to recover her by force or artifice. This he did by procuring the assassination of Neoptolemus. According to Ovid's epistle of Hermione to Orestes, Hermione had always been faithful to her first lover, and even it was by her persuasions that Orestes removed her from the house of Neoptolemus, for she was dissatisfied with the partiality of Neoptolemus for Andromache, and her attachment for Orestes was increased. There are, indeed, various opinions likewise about this: he, however, certainly managed to secure her affections, and retired to his kingdom of Argos. His old age was crowned with peace and security, and he died in the 90th year of his age, leaving his throne to his son Tisamanes by Hermione. Three years after, the Heraclidæ recovered the Peloponnesus, and banished the descendants of Menelaus from the throne of Argos. Orestes died in Arcadia, as some say, by the bite of a serpent: and the Lacedæmonians, who had become his subjects at the death of Menelaus, were directed by an oracle to bring his bones to Sparta. They were some time after discovered at Tegea, and his stature appeared to be seven cubits, according to the traditions mentioned by Herodotus and others. The friendship of Orestes and of Pylades became proverbial: and the two friends received divine honours among the Scythians, and were worshipped in temples.

ORFA, a considerable town of Diarbeck (anciently Mesopotamia) in Asia, very pleasantly situated, and well fortified. It formerly belonged to Persia; but is now in the Turkish dominions, and is a place of very good trade. It has a stately castle standing on a hill, which makes a great show at a distance. They pretend to show the well where Rachel watered her father's camels when Jacob met her, and they call it *Abraham's well*. E. Long. 37. 45. N. Lat. 36. 20.

ORFFYREUS's WHEEL, in *Mechanics*, is a machine so called from its inventor, which he asserted to be a perpetual motion. This machine, according to the account given of it by Gravesande, in his Oeuvres Philosophiques, published by Allemand, Amst. 1774, consisted externally of a large circular wheel, or rather drum, 12 feet in diameter, and 14 inches deep; being very light, as it was formed of an assemblage of deals, having the intervals between them covered with waxed cloth, to conceal the interior parts of it. The two extremities of an iron axis, on which it turned, rested on two supports. On giving a slight impulse to the wheel, in either direction, its motion was gradually accelerated; so that after two or three revolutions it acquired so great a velocity as to make 25 or 26 turns in a minute. This rapid motion it actually preserved during the space of two months, in a chamber of the landgrave of Hesse, the door of which was kept locked, and sealed with the landgrave's own seal. At the end of that time it was stopped, to prevent the wear of the materials. The professor, who had been an eye-witness to these circumstances, examined all the external parts of it, and was convinced that there could not be any communication between it and any neighbouring room. Orffyreus however was so incensed, or pretended to be so, that he broke the machine in pieces, and wrote on the wall, that it was the impertinent curiosity of Professor Gravesande, which made him take this step. The prince of Hesse, who had seen the interior parts of this wheel, but sworn to secrecy, being asked by Gravesande, whether, after it had been in motion for some time, there was any change observable in it, and whether it contained any pieces that indicated fraud or deception, answered both questions in the negative, and declared that the machine was of a very simple construction.

ORFORD, a town of Suffolk in England, 88 miles from London, situated between two channels, where the river Ore, after having joined the Ald, falls into the sea. It was once a populous town, with a castle; of which, and of a nunnery near the quay, there are still some ruins. The towers of the castle and its church are a sea-mark for colliers, coasters, and ships that come from Holland. There is a light-house at Orford-Nesse, which is also of great use to seamen, and is a shelter for them when a north-east wind blows hard upon the shore. The town was incorporated by Henry III. has a mayor, 18 portmen, 12 chief burgesses, a recorder, a town-clerk, and two serjeants at mace. Though it sent members to parliament, in the 26th of Edward I. yet it had no more elections till the reign of Edward IV. It still sends two members to parliament, and has the title of an *earldom*. There are still remaining the ruins of an holy house, where the seamen's wives used to pray for the safety of their husbands. By the withdrawing of the sea, it has been deprived of its chief advantage, for it now deserves not the name of a harbour. It had the honour to give title of earl to the brave admiral Russel, which, after being many years extinct, was revived in the person of Sir Robert Walpole. The population in 1811 amounted to 737. E. Long. 1. 40. N. Lat. 52. 15.

ORGAL, among dyers, denotes the lees of wine dried.

ORGAN, in general, is an instrument or machine designed for the production of some certain action or operation; in which sense the mechanic powers, machines, and even the veins, arteries, nerves, muscles, and bones of the human body, may be called *organs*.

ORGAN, in *Music*, denotes the largest and most harmonious of all wind-instruments; on which account it is called the *organ*, *ὀργανον*, the instrument, by way of excellence; chiefly used for playing a thorough bass, with all its accompaniments.

That organs are the invention of remote antiquity has been argued, and seems now to be generally allowed; but the particular time and country in which the discovery was made appears to be lost amidst the ruins of time. In ancient authors there are a variety of passages where mention is made of the organ, but it is at least possible that an instrument is meant very different from that which now goes by the same name. From St Augustin's commentary on the 4th verse of the 150th Psalm we learn, that the Greeks had another name for those instruments in which bellows were employed; that the name *organ* was appropriated to this particular instrument merely from the usage of the Latin tongue; and that it was indifferently given to all instruments used to accompany the voice in concert. We mention this, not because we doubt of the antiquity

Organ. antiquity of the organ, but merely to show that the time of its invention cannot be determined by the era of the authors where its name occurs. As the following observation, extracted from a periodical work which has long been in deserved esteem with the public, are intended to ascertain its early use, we submit them, without commentary, to the judgment of our readers. Gent. Mag. Cassiodorus has described our organ in a few words, lib. 1. Epis. 45. Praising that art, which makes *Organa extrancis vocibus insonare, et peregrinis flatibus complet, ut musica possit arte cantare.* And the emperor Julian has given an exact description of it in an epigram which may be found in the *Anthologia*, b. i. ch. 86. In his time these instruments were in such request, that Ammianus Marcellinus, b. xiv. ch. 6. complains that they occasioned the study of the sciences to be abandoned. However, those musical instruments whose melody is produced by wind, had been known at Rome long before. Witness that agreeable poem of Capa, which for its elegance has been ascribed to Virgil; where we find that the musician introduces the wind into her pipes by means of a pair of bellows, which she holds under her arms and blows. In the hydraulic organ, the water moves the air, instead of bellows. Cornelius Severus, in his *Etna*, has given an exact description of it (A). And though there were two kinds of hydraulic and pneumatic instruments, the first of which played by the inspiration and action of bellows, and the other by the action of water, it is certain, nevertheless, that both of them were pneumatic, being inspired by the wind. And Heron of Alexandria, in his Pneumatics, has treated of Hydraulics as belonging to pneumatics. This Heron lived in the time of Ptolemy Euergetes, king of Egypt. When Suetonius says, that Nero *Organa hydraulica novi et ignoti generis circumduxit*, he did not mean that they were unknown at Rome before Nero, but that those of Nero were of a new construction. Those were the hydraulics of a new fabric, which he exhibited to the people at the public games, as Seutonius relates a little after. Heliogabalus, one of the worthy successors of Nero, like him was fond of these hydraulics; and Alexander Severus, his cousin and successor, had the same inclination. Claudian, who lived some time after, has left us this elegant description of them:

Et qui magna levi detrudens murmura tactu
Innumeras voces segetis moderatur aënæ;
Intonet erranti digito, penitusque trabali
Vecte laborantes in carmina concitat undas.

This very construction which is observed in the pipes of an organ, gradually decreasing in magnitude, has been represented in an epigram of Optatianus Porphyrius, who lived in the time of Constantine. This epigram, which is quoted in Pithon's collection of ancient epigrams, is composed of verses of an unequal length, successively increasing. This corresponds with those words of the old scholiast on Juvenal, sat. 8. ver. 270. *Tunicâ Galli utuntur in sacris in modum organi utrinque decrescentibus virgulis purpureis.*

On the whole, then, the antiquity of organs, or of instruments of a very similar nature, can scarcely be disputed; but nothing very particular respecting the time, place, or manner, of the invention can possibly be determined from those incidental observations which occur in the writings of the ancients (B). It appears indeed to have been borrowed by the Latins from the Greeks, but not to have been in general use till the eighth century; and it has been affirmed, that, in France, it was not known till the time of Louis *le Debonair*, i. e. A. D. 815, when an Italian priest taught the use and construction of it, which he himself had learned at Constantinople. By some, however, it has been carried as far back as Charlemagne, and by others as far as Pepin. Bellarmine says that the organ began to be used in the service of the church about the year 660, as Platina relates out of the Pontifical: for when Pope Vitalian reformed the singing of the Roman church, he added to it organs in order to support and embellish it. Ammonius thinks, however, that this happened after the year 820, in the time of Louis the Pious. Perhaps the learned Bingham is our surest guide in determining this point. He positively asserts † that there were no such things as organs

† Origines Sacræ.

(A) Which is thus translated by Mr Jabez Hughes:

As in an organ *, first the rushing air
A mass of waters does before it bear;
And then the waters, in their turn, we find
Drive through the hollow pipes the vanquish'd wind;
Which strongly from its strait confinement sent,
Comes loudly rattling through the narrow vent:
Still as the waters press, the spirits sound,
And spread the bubbling symphony around.
So air and water meet, &c.

* Organon Hydraulicon.

It is by no means certain that Cornelius Severus was the author of this poem, though it is published under his name by Le Clerc. Seneca's authority, on which the Younger Scaliger founds his opinion, enforces no such conclusion. He only says, that "Severus was not discouraged from writing on this subject, by its having been already treated by Ovid and Virgil." Barthius, in his notes on Claudian, refers it to Manilius, and in his *Adversaria* to some Christian writer. By others it has been ascribed to Virgil, and by Scaliger, the father, to Quintilius Varus. But though it is less clear and methodical than Virgil, and though it has been much mutilated by time, it certainly was penned by a masterly and truly poetical hand.

(B) Vitruvius describes an organ in his 10th book; and St Jerome mentions one with 12 pair of bellows, which might be heard a thousand paces, or a mile; and another at Jerusalem which might be heard at the Mount of Olives.

Organ.

organs in use in the ancient church; and that though church-music was as old as the apostles, instrumental music was not so. He also says that it was the general opinion of the learned in his days, that organs were not introduced into churches till after the time of Thomas Aquinas, A. D. 1250; and for this opinion, as far as the authority of Aquinas will go, we have a positive proof; for in his sermons we find these words: "Our church does not use musical instruments, as harps and psalteries, to praise God withal, that she may not seem to Judaize (C)." From hence it has reasonably been concluded, particularly by the learned Gregory †, that they were not used in churches in his time. Mr Wharton has also observed that *Marinus Sanutus* (who flourished A. D. 1290) first introduced wind organs into churches; from this circumstance he derived the name *Torcellus*, the name for organ in the Italian language. About this same time Durandus in his *Rationale* speaks of them as generally received in the church; and he, in Mr Gregory's opinion, is the first author who takes notice of it. These authorities are strong, and the opinions founded on them by the learned render them still more convincing: it appears, however, from the testimony of Gervas the monk of Canterbury, who flourished A. D. 1200, that organs were introduced upwards of 100 years even before that time; for in his description of Lanfranc's church, as it was before the fire in 1174, he has these words, "*Crux australis supra fornicem* organa *gestare solebat*." We do not say that this invalidates the reasoning of the learned Bingham; of that our readers are to judge, and in forming their judgments they will be determined by the credit of the testimonies which are here opposed to each other. If we suppose that of Gervas the strongest, and in opposition to the other conclude from it, that organs were introduced into England long before the 13th century, it will give some countenance to an opinion which prevails pretty generally, viz. that in Italy, Germany, and England, they became frequent about the 10th century. See MUSIC, p. 493. But however we are disposed to determine this matter (which is in itself but of little consequence), it is certain that the use of the organ was very common in the latter ages of the church, and the propriety of it was undisputed. In the last century, however, during the civil wars, organs were removed from the churches in England; and so generally reprobated, that, at the Restoration, there could scarce be found either organists, organ builders, or singers (D).

† Bingham, ubi supra.

The organs in Germany (says Dr Burney) in magnitude, and the organists in abilities, seem unrivalled in any other part of Europe, particularly in the use of pedals. In Marpurg's Essays, vol. iii. there is a minute account of a variety of organs in Germany; of all which the longest pipe of the manuals is 16 feet long, and of the pedals 32. One of the largest organs in Germany, but which Marpurg has omitted in his list, is at Gorlitz in Upper Lusatia. It would be to no purpose to enlarge our article with a more minute account of the state of organic music in different parts of the world; in various parts of the article MUSIC, observations connected with this subject will be found, and to that we must refer. We may particularly notice, for the perusal of those who wish for further information on this subject, the observations which have been made on organs in the *History of* MUSIC, at p. 493. We need scarcely refer to the life of Handel, which all our readers who are fond of music of any kind, particularly sacred, have undoubtedly perused.

The church organ consists of two parts; the main body, called the *great organ;* and the positive or *little organ*, which forms a small case or buffet, commonly placed before the great organ. The size of an organ is generally expressed by the length of its largest pipe: thus they say, an organ of 8, 16, 32 feet, &c. The organ in the cathedral church at Ulm in Germany is 93 feet high and 28 broad: its largest pipe is 13 inches diameter, and it has 16 pair of bellows.

Plate CCCXCI. fig. 1.

The several parts of the church-organ are as follows: HIH is the sound-board; which is composed of two parts, the upper board or cover HHH, and the under board HI, which is much thicker than the other; each of these consists of several planks laid with their edges to each other, and joined very close together. In the under side of the lower board there are made several channels, which run in the direction LL, MM, &c. and are continued as far as there are stops in the organ, and come almost to the edge HK. These channels are covered over very close with parchment or leather all the way, except a hole that is commonly at the fore end next HK, upon which a valve or puff is placed. These channels are called *partitions*. When this valve or flap is shut, it keeps out the air, and admits it when open. On the upper side of the lower board there are likewise cut several broad square channels, lying cross the former, but not so deep as to reach them; these lie in the direction LN, PQ, &c. To fit these channels, there are the same number of wooden sliders or registers *f, f, f,* &c. running the whole

(C) The lawfulness of using organs in churches, has, however, been ably defended by an appeal to the use which the Jews made of instruments of music in divine service; and with much reason; for were the use criminal in us, as was asserted by many well-meaning men of the last century, and as it is still thought by some in this, it would unquestionably have been equally unlawful for the Jews. The Christians in Aquinas's time, however, acted wisely in avoiding the use of them, if by so doing they would have given offence to their weaker brethren. For though they are highly ornamental, and in some churches may be productive of good effects, yet the use of them is far from being essential, and may be easily dispensed with.

(D) Organs have never yet been used in the establishment of Scotland, since that became Presbyterian; but they are used in Holland, where that form of church-government also obtains. Bishop Horne, in a sermon which he preached at the opening of the new organ at Canterbury in 1784, says that he believes some Presbyterian dissenters in England have adopted it in their places of worship. See his Sermon, p. 8.

Organ. whole length; and these may be drawn out or thrust in at pleasure. The number of these is the same as that of the stops in the organ.

IKKK is the wind-chest, which is a square box fitted close to the under side of the lower board, and made air-tight, so that no air can get out but what goes through the valves along the partitions.

VV are the valves or puffs which open into the wind-chest; they are all inclosed in it, and may be placed in any part of it, as occasion shall require. One of these valves, with the spring that shuts it, and the wire that opens it, is represented by fig. 2. Fig. 2.

C, D, E, F, &c. are the keys on which the fingers are placed when the organ is played: these keys lie over the horizontal bar of wood W, in which are stuck an equal number of wire-pins z, z, on which keys are fixed; and the keys move up and down on the bar, as on a centre. There is another bar, against which the keys fall when put down, and which is here marked 3: on this also are several wires, which go through the keys, to guide them; and on this bar a list is fastened to hinder the keys from knocking against the wood.

The keys are made to communicate with the valves several ways, as we shall now describe. First, *s*, *s*, *s*, are the key-rollers, moving on the pivots *t*, *t*: these rollers lie horizontally, one above another, and are of such a length as to reach from the valve to the key: *a*, *a*, *a*, are arms or levers fixed to the key-rollers; *w*, *w*, the valve-wires fixed to the arms *a*, *a*, and to the valves V, and go through the holes *h*, *h*, in the bottom of the wind-chest: *b*, *b*, *b*, are likewise arms fixed to the key-rollers: *d*, *d*, *d*, the key-wires, fixed to the arms *b*, *b*, and to the keys C, D, E. Now, when the end of any one of the keys C, D, E, is put down, it pulls down the arm *b*, by the wire *d*, which turns about the roller *s* with the arm *a*, that pulls down the wire *w*, which opens the valve that is shut by the spring as soon as the pressure is taken off the key. In this construction there must be a worm spring fastened to the key, and to the bar W on the further side, to keep down the end 5 of the key.

Another method of opening the valves is thus: *x y*, *x y*, are slender levers, moveable on the centres 1, 1; 5 *x*, 5 *x*, are wires going from the further ends of the keys to the ends *x* of the levers; *y* V, *y* V, are other wires, reaching from the ends *y* of the levers, through the holes *h*, to the valves V. So that putting down the key C, D, &c. raises the end 5, which thrusts up the end *x* of the lever, by the wire 5 *x*; this depresses the end *y* of the lever, which pulls down the wire *y* V, and opens the valve V.

A third way of opening the valve is this: At the end of the key *b*, is a lever, 8, 9, moving in the centre 7. This makes, with the key, a compound lever. From the end 9, a wire goes to the valve. Now the putting down the end 6 of the key, raises the end 8, which depresses the end 9, of the lever 8, 9, pulls down the wire, and opens the valve. There is only one of these drawn in the scheme, and but a few of the others, to avoid confusion.

R, R, are the rollers, to move the sliders, by help of the arms *c f*, *c f*, which are fixed horizontally in these rollers: *k e*, *k e*, are also levers fixed in the rollers; *l e*, *l e*, are the handles, which lie horizontally, and pass through the holes *l l*; they are fastened to the lever *k c*, being moveable about a joint at *e*. Organ.

Now, any handle *l p*, being drawn out, pulls the end *e* towards *l*, which turns about R *k*, along with the arm *c f*; and the end *f* pulls out the slider *f g*; and when *p* is thrust in, the arm *c f* likewise thrusts in the slider *f g*.

Upon the several rows of holes which appear on the top of the upper board, there are set up an equal number of rows of pipes. The pipes of an organ are of two kinds; the one has a mouth like a flute, the other with reeds. The first, called *pipes of mutation*, consist, (1.) of a foot AABB (fig. 3.), which is a hollow cone, that receives the wind that is to sound the pipe: (2.) To this foot is fastened the body of the pipe BBDD. Between the foot and the body of the pipe is a diaphragm or partition FEF, that has a long but narrow aperture, by which the wind comes out; over this aperture is the mouth BBC, whose upper lip C, being level, cuts the wind as it comes out. Fig 3.

The pipes are of pewter, of lead mixed with a twelfth part of tin, and of wood. Those of pewter are always open at their extremities: their diameter is very small, and their sound very clear and shrill. Those of lead mixed with tin are larger; the shortest are open, the longest quite stopped; those of a mean size are partly stopped, and have beside a little ear on each side the mouth, to be drawn closer or set further asunder, in order to raise or lower the sound. The wooden pipes are square, and their extremity is stopped with a valve or tampion of leather. The sound of the wooden and leaden pipes is very soft; the large ones stopped are commonly of wood, the small ones of lead. The longest pipes give the gravest sound, and the shortest the most acute: their lengths and widths are determined by a fixed proportion to their sounds; and their divisions are regulated by a rule, which is called the *diapason*. The longest has commonly 16 feet; but in very large organs it has 32 feet. The pedal tubes are always open, though made of wood and of lead. Whatever note any open pipe sounds, when its mouth is stopped, it will sound an octave lower; and a pipe of twice its capacity will likewise sound an octave lower.

A reed-pipe consists of a foot AABB (fig. 4.), that carries the wind into the shallot or reed CD, which is a hollow demi-cylinder, fitted at its extremity D, into a sort of mould, by a wooden tampion G. The shallot is covered with a plate of copper KKLL, fitted at its extremity II, into the mould, by the same wooden tampion. Its other extremity KK is at liberty: so that the air entering the shallot makes it tremble or shake against the reed; and the longer that part of the tongue IL, which is at liberty, is made, the deeper is the sound. The mould II, that serves to fix the shallot or reed, the tongue, tampion, &c. serves also to stop the foot of the pipe, and make the wind go out wholly at the reed. Lastly, in the mould is soldered the tube HH, whose inward opening is a continuation of that of the reed: the form of this tube is different in different ranks of pipes. The degree of acuteness or gravity in the sound of a reed pipe, depends on the length of the tongue, and that of the pipe CK, taken from the extremity of the shallot to the extremity of the tube. The quantity or intention of the sound depends on the width of the reed, Fig 4.

the

ORGAN. *PLATE CCCXCI.*

Fig. 1.

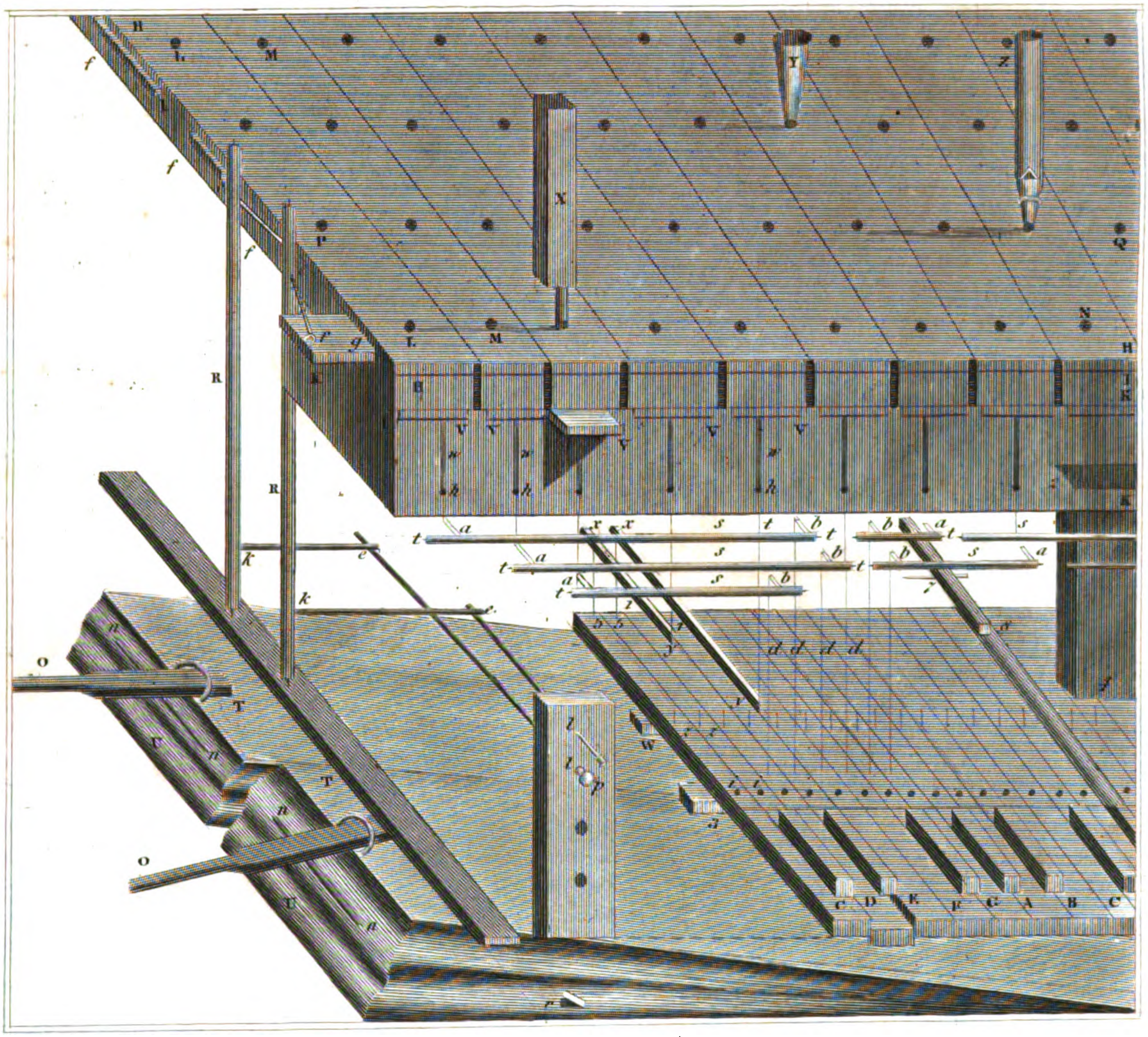


Fig. 2

Fig. 3.

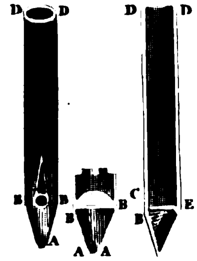
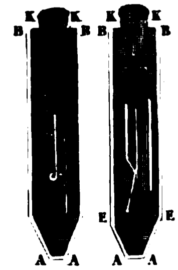


Fig. 4.



Engraved by W.D. Lizars Edinburgh.

the tongue, and the tube; as also on the thickness of the tongue, the figure of the tube, and the quantity of wind. To diversify the sounds of the pipes, a valve is added to the port-vent, which makes the wind go out in fits or shakes. In fig. 1. X represents a flute-pipe of wood, Z a flute-pipe of metal, Y a trumpet-pipe of metal. The pipes, to prevent them from falling, pass through holes made in boards, placed upon the upper board.

The pipes are made to communicate with the wind-chest in the following manner. There are holes bored that go through the upper and lower boards, and through the slider (when it is drawn out), into the partition below; so that any pipes placed upon those holes will then communicate with the partition, which by its valve, communicates with the wind-chest. But when the slider is thrust in, its holes do not answer to those in the upper and lower boards; therefore, the communication is stopped, so that no wind can get to the pipe.

To every large organ there must be at least two pair of bellows, which are marked in fig. 1. by TU, TU.
Plate CCCXCI. O, O, are the handles, moving upon the axis *n n*, *n n*. Each of these bellows consists of two boards, the lowest of which is immoveable; and in this there is a valve *r*, opening inwards, and a tube leading to it, called the *conveying tube*. There is also a hole in this under board, from which a tube leads to the port-vent, which is a square tube marked 4, rising upward, and inserted into the under side of the wind-chest at 2. In the tube leading to the port-vent, there is a valve that opens towards the port-vent, and suffers the air to go up the port-vent, but not to return. Now the handle Θ being pulled down, raises the upper board T, and the air enters through the valve *r*; and when the handle is let go, the weight of the upper board, which carries three or four pounds to every square foot, continually descending, drives the air through the port-vent to the sound-board: and as the bellows work alternately, one pair is constantly descending, which occasions a continual blast through the port vent. In chamber organs there is but one pair of bellows; but they are formed of three boards, in the manner of a smith's bellows, and so have a continual blast. All the internal structure of the organ is concealed from the sight by the front of the instrument, which stands upon the part between the numbers 3 and 6 (fig. 1.).

In every organ, the number of partitions LL, MM, &c. there are in the sound-board (fig. 1.), that of the valves VV, that of the rollers *s s*, or of the levers *x y* or 8 9 and their wires, and that of the keys ABC, &c. must be always equal. Large organs have commonly four or five sets of keys, beside those that belong to the pedals or large pipes, the stops to which are played by the feet; said to be the invention of Bernard, a German, about the year 1400. These command certain pipes, which, to increase the harmony, are tuned below the diapason. The keys of an organ are usually divided into four octaves; which are, the first sub-octave, second sub-octave, middle octave, and first octave. Each octave is divided into 12 stops or frets, of which seven are black and five white: the former mark the natural notes, and the latter the artificial notes, that is, flats and sharps. The number of keys, therefore, when there are four octaves, must be 48. Some organists add one or more stops to the first and second sub-octaves. The pedals have two or three octaves, at the option of the organist; so that the number of stops is indeterminate. The keys are placed between GG (fig. 1.), but the scheme could not contain them all. There are also as many handles *l*, *l*, &c. rollers RR, &c. sliders *f*, *f*, &c. as there are stops upon the organ; and it must be observed, that between the sliders *f*, *f*, &c. there are as many sliders on the right hand, and the same number of handles and rollers, and other rows of pipes placed between LN, PQ, which could not be expressed in the figure.

The least pipes and partitions are placed toward the middle of the organ, and the greatest on the outside. The stops of an organ have various denominations, according to the sounds they are to produce; some of which are diapason, principal, fifteenth, twelfth, tearce, cornet, trumpet, French horn, vox humana, flute, bassoon, cremona, &c. The foreign organs, especially those of Germany, have many more: particularly that in the abbey church of Weingarten, a town in the Upper Palatinate, which has 66 stops, and contains no fewer than 6666 pipes. The organ at Haerlem is said to have 60 stops, many of them but little known to the English workmen, and distinguished by names that express the sound which they produce.

When this magnificent instrument is played, the handle O of the bellows is first put down, which raises the upper board T, and gives room for the air to enter by the valve *r*. Then the other handle O is put down: In the mean time the board T, belonging to the first handle, descending, and shutting the valve *r*, drives the air through the other valve, up the port-vent, and into the wind-chest. Then drawing out any handle, as that of the flute-stop *p l*, which draws out the slider *f g*, all the pipes in the set LN are ready to play, as soon as the keys C, D, E, &c. are put down: therefore if the key D be put down, it opens the corresponding valve *m* V, through which the air enters into the pipe X, and makes it sound. In the same manner any other pipe in the set LN, will sound when its key is put down: but no pipe, in any other set, will sound till the slider be drawn out by its corresponding handle.

Among the modern improvements of the organ, the most remarkable are the swell and the tremblant: the former, invented by an English artist, consists in a number of pipes placed in a remote part of the instrument, and inclosed in a kind of box, which being gradually opened by the pressure of the foot, increases the sound as the wind does the sound of a peal of bells, or suppresses it in like manner by the contrary action. The tremblant is a contrivance by means of a valve in the port-vent, or passage from the wind-chest, to check the wind, and admit it only by starts; so that the notes seem to stammer, and the whole instrument to sob, in a manner very offensive to the ear. There is a tremblant in the organ at the German chapel in the Savoy. See Hawkins's *History of Music*, and Burney.

Hydraulic ORGAN, denotes a musical machine that plays by water instead of wind. Of these there are several in Italy, in the grottoes of vineyards. Ctesebes of Alexandria, who lived in the time of Ptolemy Euergetes, is said to have invented organs that played by compressing the air with water, as is still practised. Archimedes

medes and Vitruvius have left us descriptions of the hydraulic organ.

In the cabinet of Queen Christina is a beautiful and large medallion of Valentinian, on the reverse whereof is seen one of these hydraulic organs; with two men, one on the right, the other on the left, seeming to pump the water which plays it, and to listen to its sound. It has only eight pipes, placed on a round pedestal. The inscription is PLACEA SPETRI, if it be not wrong copied, which we suspect to be the case.

ORGASM, οργασμος, denoting violence or turgescency; formed from οργαω, *turgeo*, "I swell," an ecstasy or impetuous desire of coition, occasioned by turgescency of the seminal vessels, which are no longer able to restrain their contents. The ancients also extend orgasm to the other humours, and even excrements, which being accumulated, and coming to ferment, demand excretion. Quincy uses orgasm for an impetuous or too quick motion of the blood or spirits; whereby the muscles are distended with an uncommon force.

ORGIA, feasts and sacrifices in honour of Bacchus, held every third year, and chiefly celebrated by wild distracted women, called *Bacchæ*. The chief solemnities were performed in the night, to conceal, perhaps, their shocking impurities; and a mountain was generally chosen as the place of celebration. They were instituted by Orpheus; and from him are sometimes called *Orphica*. Authors are not agreed as to the derivation of the word; but if we consider the frantic proceedings of the Bacchanalians, οργη, *furor*, bids fair for the true etymology. See BACCHANALIA.

Orgia, according to Servius, was a common name for all kinds of sacrifices among the Greeks, as *ceremoniæ* was amongst the Romans.

ORGUES, in the military art, are thick long pieces of wood, pointed at one end, and shod with iron, clear one of another; hanging each by a particular rope or cord, over the gateway of a strong place, perpendicularly, to be let fall in case of the approach of an enemy.

Orgues are preferable to herses, or portcullices, because these may be either broke by a petard, or they may be stopped in their falling down: but a petard is useless against an orgue; for if it break one or two of the pieces, they immediately fall down again and fill up the vacancy; or if they stop one or two of the pieces from falling, it is no hindrance to the rest; for being all separate, they have no dependence upon one another.

ORGUES, is also used for a machine composed of several harquebuss or musket barrels bound together, by means whereof several explosions are made at the same time. It is used to defend breaches and other places attacked.

ORGYA, οργυια, an ancient Grecian measure containing six feet.

ORIBASIA, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 47th order, *Stellatæ*. See BOTANY *Index*.

ORIBASUS, a celebrated physician, greatly esteemed by the emperor Julian, in whose reign he flourished. He abridged the works of Galen, and of all the most respectable writers on physic. This was done at the request of the emperor. He accompanied Julian into the east, but his skill proved ineffectual in attempting to cure the fatal wound which his benefactor had received. After Julian's death he fell into the hands of the barbarians.

ORICHALCUM, or AURICHALCUM, a metallic substance resembling gold in colour, but very inferior in value. It was well known to the old Romans, who often took advantage of its resemblance to gold: for some sacrilegious characters, who could not resist the temptation of taking gold from temples and other public places, chose to conceal their guilt by replacing it with orichalcum. It was thus that Julius Cæsar acted when he robbed the capitol of 3000 pounds weight of gold; in which he was followed by Vitellius, who despoiled the temples of their gifts and ornaments, and replaced them with this inferior metal. It has been a matter of dispute with philosophers and others, what this metal could be, or how it was procured or made; it is probable at least that it was greatly analogous to our brass, if not wholly the same with it (See BRASS). The value of our brass is much less than that of gold, and the resemblance of brass to gold, in colour, is obvious at first sight. Both brass and gold, indeed, are susceptible of a variety of shades of yellow; and, if very pale brass be compared with gold, mixed with much copper, such as the foreign goldsmiths, especially, use in their toys, a disparity may be seen; but the nearness of the resemblance is sufficiently ascertained in general, from observing that substances gilded with brass, or as it is commonly called *Dutch leaf*, are not easily distinguished from such as are gilded with gold leaf.

The Romans were not only in possession of a metallic substance, called by them *orichalcum*, and resembling gold in colour, but they knew also the manner of making it, and the materials from which they made it were the very same from which we make brass. There are, indeed, authors of great repute who think very differently; and who consider the art of making brass as an invention wholly modern. Thus M. Cronstedt does not think it just to conclude from old coins and other antiquities, that it is evidently proved that the making of brass was known in the most ancient times *; and the authors of the French Encyclopedié assure us, that our brass is a very recent invention (A). It appears, however, from Pliny's Nat. Hist. lib. xxxiv. § 2. and from the concurring testimony of other writers, that orichalcum was not a pure or original metal; but that its basis was copper, which the Romans changed into orichalcum by means of *cadmia*, a species of earth which they threw upon the copper, and which it absorbed. It has indeed been contended, that the cadmia of Pliny was native arsenic; an opinion which scarcely merits confutation, but which must appear extremely groundless, when we reflect

* Miner. p. 218.

(A) Art. Orichalque.—"The vessels here called brazen, after ancient authors, cannot have been of the materials our present brass is composed of; the art of making it is a modern discovery." See *Laughton's History of Ancient Egypt*, p. 58.

reflect that it is impossible to make either brass or copper from arsenic, and that Pliny expressly calls it a *stone* from which brass was made. The testimony of Ambrose bishop of Milan, in the 4th century, and of Primasius bishop of Adrumetum, in Africa, in the 6th, and of Isidorus bishop of Seville in the 7th, all seem to confirm Pliny's account. We may therefore safely conclude that the Romans knew the method of making brass by mixing *cadmia* or *calamine* with copper; yet it is probable they were not the inventors of this art; but that they borrowed it from some other country. It appears from a variety of testimonies that brass was made in Asia, in a manner very similar to that at Rome; and a variety of places are mentioned in that extensive country where it was commonly made; and it is supposed by some that in India, as well as in other parts of Asia, it was made in the remotest ages.

With respect to orichalcum, it is generally supposed that there were two sorts of it, one factitious, the other natural. The factitious, whether we consider its qualities or composition, appears to have been the same with our brass. As to the natural orichalcum, there is no impossibility in supposing, that copper ore may be so intimately blended with an ore of zinc, or of some other metallic substance, that the compound, when smelted, may yield a mixed metal of a paler hue than copper, and resembling the colour of either gold or silver. In Du Halde's history of China, we meet with the following account of the Chinese white copper. "The most extraordinary copper is called *de-tong*, or white copper: it is white when dug out of the mine, and still more white within than without. It appears by a vast number of experiments made at Pekin, that its colour is owing to no mixture; on the contrary all mixtures diminish its beauty; for, when it is rightly managed, it looks exactly like silver: and were there not a necessity of mixing a little *tutenag*, or some such metal with it, to soften it and prevent its brittleness, it would be so much the more extraordinary, as this sort of copper is perhaps to be met with nowhere but in China, and that only in the province of *Yun-nan**." Notwithstanding what is here said, of the colour of this copper being owing to no mixture, it is certain that the Chinese white copper, as brought to us, is a mixed metal; so that the ore from which it is extracted must consist of various metallic substances, and from some such ore it is possible that the natural orichalcum, if ever it existed, may have been made. But, notwithstanding that the existence of natural orichalcum cannot be shown to be impossible, yet there is some reason to doubt whether it ever had a real existence or not.

* *Phil. Trans.* vol. i. p. 16.

We know of no country in which it is found at present; nor was it anywhere found in the age of Pliny; nor does he seem to have known the country where it ever had been found. He admits, indeed, its having been formerly dug out of the earth; but it is remarkable, that in the very passage where he is mentioning by name the countries most celebrated for the production of different kinds of copper, he only says in general concerning orichalcum, that it had been found in other countries, without specifying any particular country. Plato acknowledges, that orichalcum was a thing only talked of even in his time; it was nowhere then to be met with, though in the island of Atlantis it had been formerly extracted from its mine. The Greeks were in possession of a metallic substance, called *orichalcum*, before the foundation of Rome; for it is mentioned by Homer and by Hesiod; and by both of them in such a manner as shows that it was then held in great esteem. Other ancient writers have expressed themselves in similar terms of commendation; and it is principally from the circumstance of the high reputed value of orichalcum that authors are induced to suppose the ancient orichalcum to have been a natural substance, and very different from the factitious one in use at Rome, and probably in Asia, and which it has been shown was nothing different from our brass.

But this conclusion cannot be validly drawn from their encomiums upon it; for at whatever time the method of making it was first discovered, both its novelty and scarceness, joined to its utility, would enhance its value, at least there can be no absurdity in supposing, that when first introduced it was greatly prized, even though it be granted that it possessed no other properties than such as appertain to brass.

Respecting the etymology of the word there is great diversity of opinions. Those who write it *aurichalcum* think it is composed of the Latin word *aurum*, "gold," and the Greek χαλκος, "brass or copper." The most general opinion is, however, that it is composed of 'ορος, "a mountain", and χαλκος, alluding perhaps to its being found in mountains or mountainous countries. The above account is chiefly extracted from a paper in the second volume of Memoirs of the Literary and Philosophical Society of Manchester, written by the present bishop of Landaff, Dr Watson, and communicated by Dr Percival. To this paper then we refer our readers who desire a more copious account of it. To the above two etymological meanings of the word we shall subjoin the following, mentioned by the learned bishop, and which, in our opinion, is equally well founded, and certainly as ingenious, as the other two.

The Hebrew word *Or*, *Aur*, signifies light, fire, flame; the Latin terms *uro*, "to burn," and *aurum*, "gold," are derived from it, in as much as gold resembles the colour of flame: and hence it is not improbable, that orichalcum may be composed of an Hebrew and Greek term, and that it is rightly rendered, *flame-coloured copper*. In confirmation of this, it may be observed, that the Latin epithet *lucidum*, and the Greek one φαεινον, are both applied to orichalcum by the ancients. See also *Beckmann*, *Hist. of Invent.* iii. 71.

ORIFICE, the mouth or aperture of a tube, pipe, or other cavity.

ORIGANUM, Origany or *Marjoram*, a genus of plants belonging to the didynamia class, and in the natural method ranking under the 42d order, *Verticillatæ*. See Botany *Index*.

ORIENT, a town and harbour of France, in the department of Morbihan, in the bottom of the bay of St Louis. Since the year 1720, a handsome town has been built here, where the French East India Company had large magazines. It was formerly a free port. The number of inhabitants in 1800 was 19,922. The English attempted to become masters of it in 1746, but miscarried. W. Long. 3. 16. N. Lat. 47. 45.

ORIENTAL Philosophy. See Philosophy.

ORIGEN, one of the most celebrated ecclesiastical writers, greatest geniuses, and most learned men of the

Origen. the primitive church, during the third century, was born at Alexandria in the year 185: and was surnamed *Adamantus*, either from his indefatigable application to study, or from the firmness he discovered amidst the torments he suffered for the faith. Leonidas, his father, trained him at home with great care, and made him apply to the study of the Holy Scriptures from his infancy, in which he made surprising progress. The son's inclination and turn suited exactly with the father's design; for he pursued his studies with a most extraordinary zeal and ardour: and, being endued with a quick apprehension and a strong imagination, did not content himself with that sense which at first presented itself, but farther endeavoured to dive into mysterious and allegorical explications of the sacred books. He would sometimes even puzzle his father, by too much soliciting him for recondite meanings; which obliged the good man to reprehend him a little, and withal to advise him not to attempt to penetrate too far in the study of the Holy Scriptures, but to content himself with their most clear, obvious, and natural sense. Hence it appears, how early he was seized with that *furor allegoricus*, as a learned modern calls it, that rage of expounding the Scriptures allegorically, which grew afterwards to be even a distemper, and carried him to excesses which can never be excused (A). He had afterwards in philosophy Ammonius the celebrated Christian philosopher, and St Clement of Alexandria for his master in divinity. At 18 years of age he succeeded that great man in the office of catechist; an important employment, which consisted in teaching divinity, and expounding the Scriptures. Leonidas his father had suffered martyrdom the year before, during the persecution of Severus in 202; and Origen had shown such eagerness to follow his father to martyrdom, that his mother was obliged to hide his clothes to prevent his going abroad. Origen had a great concourse of auditors who attended his school, some of whom were of the faithful, and the others pagans. He confirmed and strengthened the first in their faiths, and converted most of the others; and there were such a number of martyrs amongst his disciples, that it might be said, that he kept rather a school of martyrdom than of divinity. He taught the doctrines of Christianity to the girls and women as well as to the men; and taking in a too literal sense what Christ says of becoming voluntary eunuchs, castrated himself to prevent his deserving or suffering scandal. He took a voyage to Rome in 211, in the beginning of Caracalla's reign, under the pontificate of Zepherinus. At his return he published many works, by which he acquired an extraordinary reputation, that drew to him a great number of auditors. But Demetrius, bishop of Alexandria, conceiving a jealousy of him, endeavoured by various pretences to injure him. At length Origen went to Antioch, whether the empress Mammæa had sent for him to hear him discourse on the Christian religion. He did not however stay long there, but returned to Alexandria, where he continued to teach till the year 228, when he left that city, and travelled into Achaia. In that journey he went into Palestine, and was ordained by the bishops of that province at 42 years of age. His being ordained by foreign bishops, without the permission of Demetrius, renewed that prelate's resentment against him; on which Origen hastily returned to Alexandria, to endeavour to mollify him: but Demetrius drove him from thence in 231, and caused him to be excommunicated, and even deposed in a council held in Egypt. Origen then retired to Cæsarea in Palestine, where he raised a celebrated school, and had St Gregory Thaumaturgus, and a great number of other persons who were illustrious for their virtue and learning, for his disciples. He afterwards travelled to Athens; and then, at the desire of Firmilianus, staid some time at Cæsarea in Cappadocia; whence he was invited into Arabia, to convince and bring back to the truth Beryllus bishop of Bostra; who maintained that the Word had no existence before his incarnation. Origen had the happiness to make him sensible of his mistake; and some years after was sent for into Arabia by an assembly of bishops, to dispute against the Arabians, who maintained that the souls of the dead remained in a state of insensibility till the general resurrection. At length the seven persecutions of the Christians began in the reign of Decius, and none were used with greater severity than Origen. He supported with incredible constancy the dreadful torments which the persecutors of the Christians invented against them; torments that were the more insupportable, as they were made to continue a long time, and as they took the greatest care to prevent his expiring in the midst of his tortures: but in the midst of the most excruciating torments, he discovered an heroic courage, and suffered nothing to escape him that was unworthy a disciple of Jesus Christ. He died at Tyre in 254, aged 69. He was the author of a great number of excellent works. The principal of those which have been handed down to us are, 1. A Treatise against Celsus, of which Spencer has given a good edition in Greek and Latin, with notes: this learned treatise has been translated into French by Elias Bouhereau, a protestant minister, born at Rochelle. 2. A great number of Homilies, with Commentaries on the Holy Scriptures. 3. *Philocalia*, and several other

(A) He is the first Christian (whose notions on this subject have come down to us) who believed in the restitution of all things. This is his sixth distinguishing tenet; to which is added this singular notion, that as Christ had been crucified in this world to save mankind, he is to be crucified in the next to save the devils. The other obnoxious tenets of Origen are these five: viz. 1. That in the Trinity the Father is greater than the Son, and the Son than the Holy Ghost. 2. The pre-existence of souls, which Origen considered as sent into mortal bodies for the punishment of sins committed in a former state of being. 3. That the soul of Christ was united to the word before the incarnation. 4. That the sun, moon, and stars, &c. were animated and endowed with rational souls. 5. That after the resurrection, all bodies will be of a round figure. It is probable that the mystic theology of the modern Quakers and other such sects is derived from Origen. See *Mosheim. Eccl. Hist.* vol. 1st.

Origen.

other treatises. 4. Fragments of his Hexaples, collected by Father Montfaucon, in two volumes folio. Of all Origen's books, the loss of the Hexaples is most to be regretted. This work was thus named from its containing six columns; in the first of which was the Hebrew text of the Bible; in the second, the same text in Greek characters; in the third, the Greek version of the Septuagint; in the fourth, that of Aquila; in the fifth, that of Symmachus; and in the sixth Theodosian's Greek version. This admirable work gave the first hint for our Polyglot Bibles. 5. The book of Principles; of which we have only an incorrect Latin version. In all his writings he discovers a surprising degree of modesty, candour, and humility; a noble and sublime genius, profound learning, and vast erudition. His manners were extremely pure, and he had a warm zeal for spreading the truths and morals of the Gospel.

Much has been written both for and against this celebrated father, both by his contemporaries and others: he has indeed suffered great abuse, which he did not deserve, and which we shall not retail; contenting ourselves with the following account of his character by Dupin, and some remarks on it by Dr Jortin. "Origen (says Dupin) had very quick parts, a very strong and enlarged imagination; but he relied too much on the vivacity of his genius, and often lost himself, out of too great earnestness to fathom and subtilise every thing. He had a very happy invention, and a more happy delivery of what he invented: but he had not that exactness in his inventions, nor that gracefulness of delivery as might be wished. He carried on his works with so great ease, that he is said to have dictated to seven or eight persons at a time; and he was so ready in expressing himself, that he made the greatest part of his homilies extempore: upon which account his style was not very correct or coherent. He had a vast memory, but often trusted too much to it. He was a person of most profound learning: he particularly sudied Plato's philosophy, and was indeed too much addicted to it for a Christian. He understood likewise the doctrines of other philosophers. He applied himself mightily to the study of human learning. He was neither ignorant of history nor mythology; and he had as great a knowledge in all the profane sciences, as those who studied nothing else. But he particularly excelled in the knowledge of the Holy Scriptures, which he learned all by heart; and that he might neglect nothing for attaining a right understanding of the letter thereof, he carefully examined all the versions of the Bible, and compared them all together with the Hebrew text, subjoining a literal commentary upon the most difficult places. He was not very well skilled in the Hebrew; yet he knew enough of it to understand it, and to observe the difference of the text and the translations. Nevertheless, he did not adhere to the literal explication of the Bible, but thought it necessary, for the sake of gaining it credit with the heathens, who despised its plainness and simplicity, and of rendering it more useful to the world, to give mystical and allegorical interpretations of every thing in it."

Bibl. Aut. Eccles. tom. i.

Dr Jortin tells us, "That Origen was very learned and ingenious, and indefatigably industrious. His whole life from his early years was spent in examining, teaching, and explaining the Scriptures; to which he joined the study of philosophy and of all polite literature. He was humble, modest, and patient, under great injuries and cruel treatment, which he received from Christians and Pagans: for though he ever had a considerable number of friends and admirers, on account of his amiable qualities and useful accomplishments, he was persecuted and calumniated by men, who had neither his learning nor his virtue, degraded from the order of presbyters, driven from his home, and excommunicated by one Demetrius bishop of Alexandria, who envied him, says Eusebius, for the reputation which he had gained. His inquisitive genius, and his mixing philosophy with Christianity, led him perhaps into some learned singularities and ingenious reveries; but he was by temper far from dogmatizing in such points, from fomenting schisms, and setting up himself for the head of a party. He lived in times when Christians were not so shackled with systems and determinations as they were afterwards, nor so much exposed to disingenuous and illiberal objections; and had more liberty to pursue their inquiries and to speak their mind.—He was ever extremely sober and exemplary, practising what he preached to others; and he lived and died poor, and destitute even of common conveniences."—The most complete edition of his works is that of Father Delarue, a Benedictine, in Greek and Latin. The celebrated Montfaucon likewise published, in 2 vols folio, some remains and fragments of his *Hexapla*.

Jortin's Remarks, vol. ii. p. 234, 238.

Origen || Original.

He ought not to be confounded with another ORIGEN, a Platonic philosopher, and the disciple and friend of Porphyry, who studied philosophy under Ammonius: perhaps this Origen was the founder of the ORIGENIANS.

ORIGENIANS (*Origeniani*), ancient heretics, who even surpassed the abominations of the Gnostics.

Epiphanus speaks of them as subsisting in his time; but their numbers, he says, were inconsiderable. He seems to fix their rise about the time of the great *Origen*; but does not say that they derived their name from him. On the contrary, he distinguishes them from the *Origenists*, whom he derives from *Origen Adamantius;* adding, indeed, that they first took their name from one *Origen;* by which he intimates, that it was not the great *Origen*. And St Augustine expressly asserts, that it was another. Their doctrines were shameful: they rejected marriage; they used several apocryphal books, as the acts of St Andrew, &c. and endeavoured to excuse their open crimes, by saying, that the Catholics did the same in private.

ORIGENISTS, in church-history, a Christian sect in the fourth century, so called from their drawing their opinions from the writings of Origen. The Origenists maintained, that the souls of men had a pre-existent state: that they were holy intelligences, and had sinned in heaven before the body was created: that Christ is only the Son of God by adoption; that he has been successively united with all the angelical natures, and has been a cherub, a seraph, and all the celestial virtues one after another; that, in future ages, he will be crucified for the salvation of the devils, as he has already been for that of men; and that their punishment, and that of the damned, will continue only for a certain limited time.

ORIGINAL, a first draught or design of any thing, which serves as a model to be imitated or copied.

Original Sin, the crime of eating the forbidden fruit, of which, it is said, all mankind are guilty at their conception, by the imputation of Adam's transgression; which is accounted for by supposing, that Adam, as he was to be the father, was also the federal head and representative, of the whole human race; and that, on his sinning, all that were to spring from him partook of his crimes. See Theology, &c.

ORIGUELA, a town of Valentia in Spain. It is seated between the mountains, on the banks of the river Segura, in a place fortified by nature, and in a fertile plain abounding in all things, especially corn. It contains 21,000 inhabitants, and has a university and a bishop's see. It is defended by an old castle; and is the capital of a government independent of Valentia, whose jurisdiction extends 30 miles in length and 15 in breadth. W. Long. 0. 56. N. Lat. 38. 22.

ORILLON, in *Fortification*, is a small rounding of earth, faced with a wall; raised on the shoulder of those bastions that have casemates, to cover the cannon in the retired flank, and prevent their being dismounted by the enemy. See Fortification.

ORIOLUS, or Oriole, a genus of birds belonging to the order of picæ. See Ornithology *Index*.

ORION, in fabulous history, was the son of Jupiter, Neptune, and Mercury. For as these gods were visiting the earth, they entered the house of Hyrieus, a native of Tanagra, in Bœotia, under the character of benighted travellers, on account of his being famed for hospitality to strangers. Hyrieus treated them in the best manner in his power; and even killed an ox, the only one he had, for their entertainment. At which the gods were so pleased, that they offered the old man whatever he would ask; who letting them know that he desired nothing so much as a son, they, to gratify his wish, caused the ox's hide to be brought before them, in which, having deposited their urine, they bade him keep it under ground for nine months. He then dug for the skin, and found it in a beautiful child, whom he called *Urion, ab urina*. The name was afterwards changed into Orion by the corruption of one letter, as Ovid observes: *Perdidit antiquam litera prima sonum*. Orion soon became conspicuous; and Diana took him among her attendants, and even became deeply enamoured of him. His gigantic stature, however, displeased Oenopion king of Chios, whose daughter Hero or Merope he requested in marriage. The king, not willing to deny him openly, promised to make him his son-in-law as soon as he delivered his island from wild beasts. This task, which Oenopion supposed to be impracticable, was soon performed by Orion, who eagerly demanded his reward. Oenopion, on pretence of complying, intoxicated his illustrious guest, and put out his eyes on the sea-shore, where he had laid himself down to sleep. Orion found himself blind when he awoke. He went, directed by the sound, to a neighbouring forge, where he placed one of the workmen on his back, and by his directions went to a place where the rising sun was seen with the greatest advantage. Here he turned his face towards the luminary; and, according to report, he immediately recovered his eye-sight, and hastened to punish the perfidious cruelty of Oenopion. Orion was reported to be an excellent workman in iron, and to have fabricated a subterraneous palace for Vulcan.

Aurora, whom Venus had inspired with love, carried him away into the island of Delos, that she might enjoy his company with greater security, but Diana, who was jealous of this, destroyed him with her arrows. Some say, that Orion had provoked Diana's resentment, by offering violence to Opis, one of her female attendants; or, as others say, because he had attempted the virtue of the goddess herself. According to Ovid, Orion died of the bite of a scorpion, which the earth produced to punish his vanity, in boasting that no animal on earth could conquer him. Some say that Orion was son of Neptune and Euryale, and that he had received from his father the privilege and power of walking over the sea without wetting his feet. Others assert, that he was a son of Terra, like the rest of the giants. He had married a nymph called *Sida*, before his connection with the family of Oenopion: but Sida was the cause of her own death, by boasting herself fairer than Juno. Diodorus says, that Orion was a celebrated hunter, superior to the rest of mankind, by his strength and uncommon stature. He built the port of Zancle, and fortified the coast of Sicily against the frequent inundations of the sea, by heaping a mound of earth called *Pelorum*, on which he built a temple to the gods of the sea. After death Orion was placed in heaven, where one of the constellations still bears his name. The constellation of Orion was placed near the feet of the bull. It was composed of 17 stars in the form of a man, holding a sword; for which reason the poets often speak of Orion's sword. As the constellation of Orion, which rises about the 9th day of March, and sets about the 21st of June, is generally supposed to be accompanied at its rising with great rains and storms, it has acquired the epithet of *aquosus*, given it by Virgil. Orion was buried in the island of Delos; and the monument which the people of Tanagra in Bœotia showed, as containing his remains, was nothing but a cenotaph. The daughters of Orion distinguished themselves as much as their father; and when the oracle had declared that Bœotia should not be delivered from a dreadful pestilence before two of Jupiter's children were immolated on the altars, they joyfully accepted the offer, and voluntarily sacrificed themselves for the good of their country. Their names were Menippe and Metioche. They had been carefully educated by Diana; and Venus and Minerva had made them very rich and valuable presents. The deities of hell were struck at the patriotism of these two females; and instantly two stars were observed to arise from the earth, which still smoked with their blood, and they were placed in the heavens in the form of a crown. According to Ovid, their bodies were burned by the Thebans, and from their ashes arose two persons, whom the gods soon after changed into constellations.

Orion, in *Astronomy*, one of the constellations of the southern hemisphere. The word is formed from the Greek *ουρειν*, "to make water;" the ancients supposing that it raised tempests at its rising and setting. The stars in the constellation Orion, in Ptolemy's catalogue are 37, in Tycho's 62, in the Britannic catalogue 80.

ORISTAGNI, an ancient town of the island of Sardinia, with an archbishop's see. It is pretty large and well fortified; but thinly inhabited, on account of the unhealthy air: it is seated on the western coast, in a bay of the same name, in E. Long. 8. 58. N. Lat. 39. 55.

ORIXA or ORISSA, a province of the Deccan in Hindostan, extending from the 16th to the 23d degree of north latitude, on the west side of the bay of Bengal. Its length from S. W. to N. E. is about 530 miles, its average breadth 90. The interior is wild, rugged, and uncultivated; but the coast is generally fertile and well inhabited. The Ooreas who live within the company's jurisdiction are a quiet and inoffensive people; but those who inhabit the interior are fierce and warlike. The population of the province is supposed to be four millions and a half, but is very unequally spread over the surface of the country. Three fourths of the territory are possessed by the British, the remainder by various petty native chiefs. The temple of Juggernaut is in this province.

ORIXA, a genus of plants belonging to the tetrandria class. See BOTANY *Index*.

ORKNEY ISLANDS, called *Orcades* by the ancients, certain islands on the north of Scotland (A), from which they are separated by a frith 20 miles in length and 10 in breadth.

As writing seems to have been unknown in the northern islands, during those periods which the antiquarian would call the most curious and important, the chief part of our information respecting the ancient state of the Orkneys must be derived from tradition and conjecture. Their mountainous situation, and natural jealousy of strangers, obstructed the progress both of knowledge and religion: for instead of receiving either fro their southern neighbours, we are certain that they derived their knowledge of Christianity from Norway, during the expeditions undertaken by that nation (in the end of the 10th or beginning of the 11th century) to make settlements in the Orkneys and on the coast of Caithness (B). The best (because it is in all

 probability

(A) The northern isles of Scotland have been often mentioned by ancient authors, and called by different names from those they now go by; so that it is sometimes difficult to know which of them are meant. The ancient name, however, of the islands which are the subject of this article, has never been disputed. The *Ebudæ*, it is agreed, are the modern Hebrides; and there is no doubt of the ancient Orcades being the same with the Orkneys. Of Thule, however, we are not so certain; and whether it means the Shetland i les, or Iceland, remains undetermined. Pythias, a Massilian, pretends to have visited these islands, and particularly Thule; but he does not mention the Orcades. The geographer Mela, who was contemporary with the emperor Claudius, is the next writer who describes the northern islands. Of the Orkneys he gives a remarkably just account, and says they were thirty in number, with narrow channels between them; but he is less accurate with respect to the rest. Pliny the Elder is the third who mentions the northern islands. He makes the number of the Orkneys to be forty, and of the Hebrides to be thirty. Solinus, the supposed contemporary with Agricola, is the next after Pliny. In his time, and according to his account, these islands had not a single inhabitant, and were overgrown with rushy grass. It seems on the whole to be pretty generally allowed, that Julius Agricola, who first sailed round Britain, discovered the Orcades, till then unknown, and subdued them. The Romans, never that we know, visited these islands again but once, which was probably after Honorius had defeated the Saxons in the seas of Orkney. Claudius was so far from reducing them (as is asserted by Jerome in his Chronicle), that Juvenal has these lines in Hadrian's time:

Arma quid ultra
Littora Juvernæ promovimus et modo captas
Orcades, et minima contentos nocte Britannos. SAT. II. 160.

In vain, O Rome, thou dost this conquest boast
Beyond the Orcades' short-nighted coast. DRYDEN.

Tacitus informs us, that before the completion of the first century, the Roman fleets sailed round Scotland, and landed in the Orcades to refresh.

(B) It has been asserted, that the Orkneys, as well as the isles of Shetland, were originally peopled from Norway, in the ninth, tenth, or eleventh century. Others again imagine, with as much probability, that the Picts were the original inhabitants, and call Orkney the ancient kingdom of the Picts. Certain singular houses, now overgrown with earth, are called *Picts houses;* and the Pentland frith (formerly *Pightland* or *Pictland*) is supposed to retain their name. Claudian's lines, cited by Mr Camden, prove, that the Picts, with some other German colony, particularly the Saxons, were at that time in possession of these isles; and so Ninnius expressly says. Many of the present inhabitants use the Norse language, which differs but little from the Teutonic or Pictish language, and was in general use to the last century; but except in Foula, where a few words are still known by the aged people, it is quite lost. The English tongue, with a Norwegian accent, is that of these islands; but the appearance of the people, in their manners and genius, evidently shows their northern origin. Ninnius. c. 5. puts their arrival at Orkney not less than 900 years after the coming of Brutus into Britain, which he says was in the time of Eli the Jewish high priest. The ancient surnames are of German original. Some date the first settlement of the Picts here A. M. 4867; when, emigrating from their native country, they planted a colony in Orkney, and thence crossing Pictland frith, and traversing Caithness, Ross, Murray, Mar, and Angus, settled in Fife and Lothian; thence called by our writers *Pictlandia*. Others think they did not settle here till the time of Reuther king of Scotland, when the Picts, joining with a party of the Scots, were repulsed, with the loss of their king Gethus, and many of the Picts and Scottish nobility, with great slaughter; but the invasions of the Britons, at the same time, constrained the Picts to fly to Orkney, where they chose for king Gothus their deceased sovereign's brother, probability the most authentic) account that we have of this early part of the history of the Orkneys, seems to be in Torfæus. See TORFÆUS. His history must, doubtless, have been compiled chiefly from tradition, which is far from being the surest mode of information. During the time of Gregory the Great, when by his policy the Picts were driven from other parts of Scotland, they came to the Orcades as an asylum; but it does not appear, and is far from being probable, that they received a favourable reception, for many of them migrated to Shetland, and from thence to the opposite coasts of Norway. A particular history of these islands, during those early ages, would afford little entertainment, because its authenticity is at least doubtful. These islands were at various times harassed and plundered by adventurers from Scandinavia; and the Norwegian princes frequently laid the inhabitants under tribute.

We have said that the Christian religion was transported to the Orkneys from Norway, and that this happened in the beginning of the 11th century. About which time Sigurdis possessed the entire dominion of those isles, and for many years exercised all the powers of a monarch in the north. At the same time Christianity had dawned on Scandinavia, and had become the established religion in the seat of government in Norway. Its doctrines interwove themselves with the policy of the nation; its principles, so nearly interesting to human happiness, made their farther publication an object of much moment to the adventurous princes, and gave a new law to their enterprises. While the power of these principles was acting with original force upon the minds of the people, and their zeal rendered them ambitious of any exploit, whereby they could diffuse their influence; Olaus prince of Norway equipped a squadron destined to carry the knowledge of the gospel to other shores. On this pious adventure he was accompanied not only by numbers of all ranks, whom, as usual, a love of enterprise invited; but by many persons of distinguished knowledge and abilities, men of sincere piety, who had become particularly well acquainted with the Christian doctrines, and entertained a deep sense of their infinite importance. These entered into the fleet, joyful in the prospect of spreading the truths which they revered through yet unenlightened countries; and the squadron soon appeared off the Orcades. Olaus got Sigurdis, on board of his fleet, with his son, and but a few attendants, and, as the heir of Harold, he claimed all the provinces over which Sigurdis reigned; and at the same time he ordered him to renounce and abjure the religion of his fathers, and to embrace Christianity. Delay was not permitted; Christianity was forced upon him and his subjects; and on the departure of Olaus, he carried the son of Sigurdis as an hostage for what he had engaged; which was to give honourable protection to all those holy men who might choose to reside in those parts for the purpose of instructing the people in the nature of the Christian doctrines; for many of the more intelligent and religious men who had come from Norway with Olaus, remained in the Orcades and in the north of Scotland, to fulfil their pious resolution of spreading the light of the gospel there. Olaus, with the rest of his followers, sailed on another expedition towards the frith of Moray. The death of Kindius his son, which happened soon after Olaus's return to Norway, released Sigurdis from his engagements with him; and he entered into one with Malcolm II. one of whose daughters he had in marriage, and by whom he had a son, Torphinus. Torphinus's bravery, magnificence, generosity, and hospitality, endeared him to the inhabitants; and he ruled without controul for many years, till Ronald, a grandson of Sigurdis, who had lived in Norway, and who was esteemed the rightful heir of the earldom of Orkney, made a successful descent upon it. Torphinus wished to give him battle; and in a sea-fight, with the assistance of some ships from Arninus, a man who had filled some of the first places in Norway, he totally defeated him. By courting the friendship of that court, his dominions remained quiet for the greater part of his life; the latter part of which was no less eminent for establishing salutary laws, and encouraging the arts of industry, than the former had been distinguished for military fame and success in the exploits of war. He lived to an advanced age, until after Malcolm III. had ascended the throne of Scotland. Torphinus had built a sumptuous church in Byrsa, where the first bishops of Orkney resided. In the decline of life he retired to that island, and, finishing his days with exemplary piety, was with much solemnity interred in the temple which he had raised. His country long lamented the loss of so celebrated a ruler, who had established security in it, through the influence of his laws, and had taught it to enjoy the arts and blessings of peace. He left two sons, Paul and Erland, who through the whole of their lives amicably shared both in the honours and administration of their father's extensive domain. During this period, the northern counties are said to have arrived at a very superior degree of cultivation and improvement, which became equally conspicuous in the richness of their lands, and in the mildness of their dispositions. Their sons, however, did not both inherit their father's virtues. Magnus, the son of Erland, was pious and

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brother, till they were able to return to Lothian, and drive out the Britons. After this they flourished here, and were governed by kings of their own. There still remains a place called Cunningsga, the dwelling place of the minister of Sandwick, whose name and form bespeak it the residence of some of them. But no traces of their history remain, except the name of Belus, in ancient characters, on a stone in the church of Birsa, where still is to be seen one of the principal palaces. This government probably subsisted till the subversion of the Pictish kingdom in Scotland, A. D. 839, by Kenneth II. king of Scotland. On the whole, however, the time of the discovery and population of the Orkneys is certainly unknown. Probably it was very early; for we are told that they owe their name to the Greeks.

Orcades has memorant dictas à nomine Græco. CLAUDIAN.

and peaceable; a great promoter of religion, and anxious in patronizing the Roman missionaries, and in protecting the establishments of Christianity: but Hacon, the heir of Paul, was vehement, wild, and impatient of restraint. He saw how Magnus was revered, and envy drove him to revenge; for, by the most deliberate and deceitful villany, he got Magnus into his power, and murdered him without mercy. The latter part of his life was spent in penance, and in improving his dominions.

Magnus's singular piety, and the manner of his unfortunate death, were so well represented at the court of Rome, that he was canonized. Hacon left two sons, Paul the Silent, and Harold the Orator. Caithness came to Harold, and the Orkneys were governed by Paul.

Ronald, a descendant of St Magnus, an elegant and accomplished youth, appeared at the court of Norway, and was supported in a claim upon the Orkneys, as the heir of the canonized martyr. He sent messengers to Paul, and offered to share the government with him; but this proposal was refused, and the ambassadors were treated with great contempt. They, however, found persons of power disposed to second their master's views; who soon after their return set out, and vowed, if he succeeded, to build a magnificent church, and to dedicate it to St Magnus. All seemed satisfied with the enterprise; and, full of hope, the fleet set sail. Paul in the mean time put himself in a state of defence. By very artful manœuvres, however, Ronald obtained his purpose, and willingly shared his sovereignty with Harold, the legal heir of Paul. They lived amicably together; and on the assassination of Ronald, which was accomplished by a proud chieftain, who thought himself insulted, he was buried with great pomp. Harold now fully possessed the unrivalled sovereignty of the north, and lived long to enjoy it. We find that in 1196 he was able to bring 7000 men to the field, and a body of cavalry, against the army of William king of Scotland, but was immediately defeated. In the next year, the Caithnesians rebelled again, headed by one Roderick, and Torphinus, son to Harold. The king met and defeated them near Inverness. Roderick was slain; and William seizing on Harold in the extremity of Caithness, detained him till Torphinus surrendered himself as an hostage; but on some new treasons of the father, the king, according to the barbarity of the times, caused the eyes of the unhappy youth to be put out; and had him emasculated, of which he soon perished in prison. Harold died in the 73d year of his age; and with him ended, in its earls, the independent sovereignty of the north of Scotland. The Norwegians seem to have been in possession of these isles as late as 1266; for then Magnus IV. king of Norway, being worsted in war with the Scots, yielded them to Alexander III. king of Scotland by treaty, and Haquin king of Norway confirmed the possession of them to King Robert Bruce in the year 1312. Lastly, in 1464, Christian I. king of Norway and Denmark, when he gave his daughter in marriage to James III. king of Scotland, transferred all his right to them to his son-in-law and his successors; to make which more binding the Pope's confirmation was obtained. We are told by some, that Magnus sold them to Alexander for the sum of 4000 merks sterling, and a yearly acknowledgement of 100 merks.

They are about 30 in number; but many of them are uninhabited, the greater part being small, and producing only pasturage for cattle. The principal islands are denominated by the names of *Mainland*, *South Ronaldsha*, *Swinna*, *Flotta*, *Copinsha*, *Strupensha*, *Stronsa*, *Sanda*, *&c.* the terminations in *a*, or *ha*, being generally given in the Teutonic to such places as are surrounded by water. The currents and tides flowing between the islands are extremely rapid and dangerous. Near an island called *Swinna*, are two great whirlpools, called the *wells of Swinna*, which are counted dangerous by mariners, especially in a calm. When sailors find themselves sucked into the vortex, it is said they throw out a barrel, or some bulky substance, which smooths the water till it is sucked down and thrown up at a considerable distance, during which time the ship passes over in safety. But when there is a breeze of wind, these whirlpools may be crossed without any danger. The largest of these islands is called *Pomona*, in length 33, and in breadth 9 miles, containing 9 parish-churches, and 4 excellent harbours.

The air of these islands is moist, on account of the neighbourhood of the sea; and frost and snow do not continue long. In some places the soil is bare and mountainous, and in others sandy and barren; however, many of the islands produce large crops of barley and oats, but no wheat or other grain excepting what is inclosed in gardens. These, when duly cultivated, produce all kinds of kitchen herbs and roots, bringing even fruit-trees to maturity; but out of them, in the open country, there is scarce a tree or shrub to be seen, except juniper, wild myrtle, heath, and the cyur-hodon: yet this deficiency cannot be imputed to the poverty of the soil, or the nature of the climate: for the trunks of large oaks are frequently dug up in the marshes. This is likewise the case in the most barren parts of the Highlands of Scotland, where not a shrub is to be seen above the surface of the earth: nay, the inhabitants frequently find, deep in the earth, the roots of large trees, evidently exhibiting marks of the axe by which they were felled; so that these northern parts must have undergone some strange revolutions. The Orkneys produce great variety of herbs and berries, grass and corn, which last is exported as far as Edinburgh. In some of the islands, the natives have discovered mines of tin, lead, and silver, though none of them are wrought to any advantage; in others, we find abundance of marl, gray and red slate, quarries of freestone, and even of marble and alabaster. When the wind rages to any violence, the sea throws in plenty of timber, torn from other countries; and, not unfrequently, the people find large pieces of ambergrease. The fresh water in these islands is very pure and limpid; and though there are no large rivers in the Orkneys, the ground is well watered with lakes and pleasant rivulets, that not only serve to turn their mills, but also abound with trout of the most delicate flavour.

Besides the abundance of little horses, black cattle, sheep, swine, and rabbits, the inhabitants of the Orkneys rear all sorts of domestic animals and tame poultry. Their heaths and commons yield plenty of red deer, Orkney. deer, and all sorts of game, partridges, grouse, heath-cocks, plover, duck, teal, and widgeon: the sea-coasts teem with seals and otters; and are visited by whales, cod, ling, tusk, herrings, and all manner of fish: on the shore they find spermaceti, os sepiæ, and a great variety of shells and corallines, with a multitude of oysters, remarkably large muscles, crabs, and cockles. The rocks are covered with sea-fowl, wild geese, solan geese, barnacles, eagles, hawks, and kites. With respect to the barnacles, or, as the natives call them, the *cleck geese*, they are said to be found in shells sticking by the bills to trees, in several islands. Martin affirms he has seen them in this situation, but could not perceive them alive; and indeed the whole account of their generation and production, exhibited by the northern naturalist, is absurd and unphilosophical. The Orkney eagles are so strong, that according to the reports of the country, they have been known to carry away young children in their talons. Certain it is, they make such havock among the lambs, that he who kills an eagle is entitled by law to a hen from every house in the parish where it was killed. The king's falconer visits these islands every year, in order to fetch away the young hawks and falcons from their nests among the precipices: he enjoys a yearly salary of 20l. and may claim a hen or a dog from every house in the country, except those that are expressly exempted from this imposition.

The gentry of the Orkneys are civilized, polite, and hospitable; and live like those of Scotland, from whom they are chiefly descended. They live comfortably, are remarkably courteous to strangers, and drink a great quantity of wine, with which their cellars are generally well stored. Indeed the inhabitants of the Orkneys may be now justly deemed a Scotch colony. They speak the language, profess the religion, follow the fashions, and are subject to the laws, of that people. They are frugal, sagacious, circumspect, religious, and hospitable. The mariners are remarkably bold, active, dexterous, and hardy. Many surprising instances of longevity occur here, as well as in Shetland, of persons living to the age of 140. The Orkney women are generally handsome, and well shaped, and bring forth children at a very advanced age. In the Orkneys, some particular lands are held by a tenure called *Udal Right*, from Ulcrus, or Olaus, king of Norway, who farmed the lands, on condition of receiving one-third of the produce; and this right devolved in succession, without any charter granted by the sovereign. The inhabitants of Orkney, instead of measuring their corn, weigh it in pismores or pundlers. Their least denomination is a mark, consisting of 18 ounces, and 24 marks make a lispound, which is a Danish quantity. The poorer sort of people in the Orkneys appear veay meanly habited, with a piece of seal skin, instead of shoes; and living chiefly on salt fish, are subject to the scurvy. They are much addicted to superstitious rites; in particular, interpreting dreams and omens, and believing in the force of idle charms. The islands of Orkney, we have already observed, produce very bold, able, and hardy mariners. The common people, in general, are inured to fatigue, and remarkably adventurous, both in fishing during rough weather, and in climbing the rocks for the flesh, eggs, and down of sea-fowl. Formerly, while they were exposed to the invasions of the Norwegians, or western islanders, every village was obliged to equip a large boat well manned; and all the fencible men appeared in arms, when the alarm was given by the beacons lighted on the tops of the rocks and highest mountains. These beacons, known by the name of *ward-hills*, are still to be seen in every island. Their corn land they inclose with mud or stone walls, to preserve it from the ravages of their sheep, swine, and cattle, which wander about at random, without being attended by herdsmen: their ordinary manure, especially near the sea-coast, is sea-weed, which they carefully gather and divide into equal portions. Their sheep are marked on the ears and nose; but so wild, that when they have occasion to shear them in the month of May, they are obliged to hunt every individual, with dogs trained for that purpose. Their manner of catching sea-fowl is curious and particular. Under the rock where these fowls build they row their boat, provided with a large net, to the upper corners of which are fastened two ropes, lowered down from the top of the mountain by men placed in that station. These hoisting up the net, until it be spread opposite to the cliffs in which the fowls are sitting, the boatmen below make a noise with a rattle, by which the fowls being frightened, fly forwards into the bosom of the net, in which they are immediately enclosed and lowered down into the boat; others practise the method used in Iceland and Norway, and are lowered down by a single rope from the summit of the mountain; this is the constant way of robbing the hawk's nest. See *Bird-Catching*. In these islands some strange effects are produced by thunder and lightning. In the year 1680, the lightning entered a cow-house, in which 12 cows stood in a row, and killed every second beast as she stood, and left the rest untouched. The distempers that prevail mostly in the Orkneys are agues, consumptions, scurvy, and itch. The agues, which abound in the spring, the natives cure with a diet drink of bitters and antiscorbutics infused in ale: for phthisical complaints they use the plant arby, and the caryophyllus marinus boiled with sweet milk.

The isles of Orkney and Shetland compose one stewartry, and send one member to the imperial parliament. The right of superiority to the Orkneys was dismembered from the crown by the union parliament, and granted for a certain yearly consideration to the earl of Morton, by Queen Anne, who appointed him hereditary steward and justiciary. This nobleman possesses the power of creating certain judges, called *bailiffs*. There is one of these established in every island and parish, with power to superintend the manners of the inhabitants, to hold courts, and determine civil causes, according to the laws of Scotland, to the value of ten pounds Scots money, amounting to 16s. 8d.: but all contests of higher import are referred to the decision of the steward or his deputy, who resides at Kirkwall, which is the seat of justice. Subservient to the bailiffs are six or seven of the most reputable and intelligent inhabitants, who oversee the conduct of their fellows, acting as constables, and make report of all enormities to the bailiff; who causes the delinquent to be apprehended and punished; if the crime be within the extent of his judicial power; otherwise he transmits him to Kirkwall, where he is tried by the steward. The Protestant

testant religion prevails in the isles of Orkney, according to the rites and discipline of the kirk; these, and the isles of Shetland, constituting one presbytery, which assembles at Kirkwall. The country is divided into 18 parishes, containing 31 churches, and above 100 chapels.

The trade of the Orkneys is not very considerable, though it might be extended to great advantage. They supply with fresh provisions, for ready money, the ships and vessels that touch upon the coast in the course of northern voyages, or in their passage from the East Indies, when they go north about Ireland and Scotland, in time of war, to avoid the privateers of the enemy. They are also visited by those engaged in the herring-fishery, though there is not such a resort on this account to these islands as to the isles of Shetland. Nevertheless a good number of boats from the western parts of Scotland, as well as from Londonderry, Belfast, and other parts of Ireland, fish for herring as far north as the Leuze, and supply the Orkneys with tobacco, wine, brandy, and other spirituous liquors, cloths, and divers manufactures. These they change for fish, and oil extracted from porpoises, seals, and other sea animals. The people of Orkney export annually great numbers of black cattle, swine, and sheep; together with large quantities of corn, butter, tallow, salt, and stuffs made in the country, over and above the skins of seals, otters, lambs, and rabbits, down, feathers, writing-quills, hams, and wool; yet all these articles would, in point of profit, fall infinitely short of their herring fishery, were it prosecuted with industry, economy, and vigour.

The most valuable of their manufactures is kelp, and indeed the staple commodity was first introduced in 1722, by a Mr James Fea, of Whitehall, in Stronsay, since which period it has been gradually on the increase. From 1763 to 1778, there was manufactured, on an average, 1800 tons annually at four guineas per ton; from 1778 to 1792, the annual average produce was 3000 at 6l. per ton; from 1792 to 1794, above 4000 tons. Thus, from 1722 to 1794. a period of 72 years, the produce of the kelp was 291,976l. sterling, or more than the value of all the Orkney islands, even at the rate of 36 years purchase; the annual rent, exclusive of the kelp and fisheries, not exceeding 8000l. sterling.

As there are no merchants in the Orkneys at present who export fish on their own account, what herrings are taken they used to sell to the Dutch or Scotch dealers in and about Inverness. They generally fish for herring on the west side of the Orkneys; and are therefore more remote from markets than those who are employed in the same manner on the coast of Shetland. In the Orkney islands they see to read at midnight in June and July; and during four of the summer months they have frequent communications, both for business and curiosity, with each other, and with the continent: the rest of the year, however, they are almost inaccessible, through fogs, darkness, and storms. It is a certain fact, that a Scotch fisherman was imprisoned in May for publishing the account of the prince and princess of Orange being raised to the throne of England the preceding November; and he would probably have been hanged, had not the news been confirmed by the arrival of a ship.

We may reckon among the curiosity of the Orkneys, the *Phaseoli*, commonly known by the name of *Molucca beans*, and sometimes they are called *Orkney beans*. They are a sort of fruit found on the shore of the Orkney islands, being thrown on them by storms of westerly wind. They are of several distinct species, and are none of them the produce of those islands, nor of any places thereabout, but are probably of American origin, many of them being plainly natives of Jamaica, and other islands of the Indies.

They are found principally on those coasts which are most exposed to the waves of the great ocean, and are on these so plentiful, that they might be gathered in large quantities, if of any value; but the only use they are put to is the making of snuff-boxes out of them. Sir Robert Sibbald, and Mr Wallace, in their accounts of Scotland, have both named them *Molucca Beans*. Many strange fishes and curious shells are also frequently cast up by the ocean; of these last a vast variety are preserved for adorning the cabinets of modern naturalists. Sometimes exotic fowls are driven upon the Orkneys by tempestuous weather: fish, as large as whitings, have been thrown ashore to a considerable distance within the land. At Cantick-head, in the island Waes, and some other places, huge stones are often heaved up by the violence of the sea and wind, and cast over high rocks upon the land. A single Laplander has been seen more than once upon this coast, in his slender canoe, covered with skins, being driven hither by adverse winds and storms. The Orkneys are not altogether destitute of ancient monuments and curiosities of art. In Hoy we find an entire stone, 36 feet long, 18 in breadth, and 9 in thickness, lying between two hills, and known by the name of *dwarfie stone*. It is hollowed within by the tools of a mason, the marks of which are still apparent. The entrance is a square hole about two feet high, with a stone, by way of door, standing before it. Within we find a bed with a pillow cut out of the stone; at the other end is a couch of the same kind; and in the middle a hearth, above which there is a hole or vent for the exit of the smoke. This curiosity is found in the midst of a desolate heath, and is supposed to have been the residence of a hermit. In the very neighbourhood of this stone there is a very high and steep mountain, called the *ward-hill of Hoy*, near the summit of which, in the months of May, June, and July, something at noon-day is seen to shine and sparkle with remarkable lustre, supposed by the common people to be an enchanted carbuncle; many persons have clambered up the hill in quest of it, but found nothing. Perhaps this splendour is produced by the reflection of the sun on a small stream of water sliding over the face of a smooth rock. At Stennis, in Mainland, there is a causeway of stones over a loch or lake, at the south end of which we observe a circle of stones rising about 20 feet above the ground, each being six feet in breadth, and from one or two feet in thickness: between this circle and the causeway two stones of the same dimensions stand by themselves, and one of them is perforated in the middle. At the distance of half a mile from the other end of the causeway appears a larger circle of the same kind of stones, the diameter of which may amount to 110 paces; some of these stones are fallen; and to the east and west of the larger circle are two artificial green mounts. Both rounds are surrounded with a ditch; and one cannot view them without admiration, considering

considering the art that must have been used to bring such unwieldy masses together in this order. They were probably temples and places of sacrifice used in times of pagan superstition; and seem to bear a great affinity with the celebrated monument called *Stonehenge* on Salisbury Plain in England. In one of the mounts, at the north end of the causeway, the natives found nine *fibulæ*, or clasps of silver, formed into a circle, and resembling a horse-shoe. In many different places of the Orkneys we find rude obelisks or single stones of a great height, set up either as a memorial of battles, treaties, or the decease of remarkable personages. In Rousay, between two high mountains, there is a place which the natives distinguish by the appellation of the *camp of Jupiter Fring*: but the meaning of this name, handed down by tradition, is not yet known. At the west end of the Mainland, near Skeal, we find a surprising causeway, above a quarter of a mile in length, on the summit of high hills, composed of reddish stones of different magnitudes, impressed with various figures both on the under and upper surface. Some gentlemen in the neighbourhood have carried off the most beautiful of these stones, to be set in their chimneys by way of ornament, like the painted tiles of Holland. This country produces many sepulchres of different nations. In the plains or links of Skeal, the sand being blown away from the surface of the ground, several square catacombs appear, built of stones well cemented together, containing some parcels of black earth, and each secured by a large stone at the mouth. Sepulchres of the same kind are found at Rousum in Stronsa; which is likewise remarkable for a different kind of monument, consisting of one entire stone cylinder hollowed, with a bottom like that of a barrel, and a round stone to fill up the entrance; above, the stone was sharpened into an edge; within were found some burnt bones and red clay; and over it was placed a large flat stone for the preservation of the whole. These, in all probability, were Roman catacombs. In Westra divers Danish graves have been discovered: in one of these appeared the skeleton of a man, with a sword on one side and a Danish axe on the other. Some have been found buried with dogs, combs, knives, and other utensils. In many places of the country we find round hillocks or barrows, here known by the name of *brogh*, signifying, in the Teutonic language, burying place, supposed to have been the cemeteries of the ancient Saxons. In different parts of these islands we see the remains of great buildings, believed to have been fortresses erected by the Danes or Norwegians when they possessed the country. One of these, in the isle of Wyre, called the *castle of Coppi-row*, signifying a town of security, is surrounded by a fosse, and the first floor still remains above ground, a perfect square of stone wall, very thick, strongly built, and cemented with lime, the area within not exceeding ten feet in length. Of this Coppi-row the common people relate many idle fables. In the chapel of Clet, in the isle of Sanda, there is a grave 19 feet long, in which was found part of a man's back bone larger than that of a horse. Human bones of nearly the same size, have been dug up in Westra; and indeed this country is remarkable for producing men of a gigantic stature. Within the ancient fabric of Lady Kirk in South Ranalshaw, there is a stone four feet long and two feet broad, on which the prints of two feet are engraven, supposed to be the place where, in times of popery, penitents stood to do public penance. The cathedral of Kirkwall, the capital of the Orkneys, is a fine Gothic building, dedicated to St Magnus, but now converted into a parish church. Its roof is supported by 14 pillars on each side; and its steeple, in which is a good ring of bells, by four large pillars. The three gates of the church are chequered with red and white polished stones, embossed and elegantly flowered.

Campbell, in his Political Survey, suggests two improvements in the Orkneys: 1. The erecting an university; of which he recapitulates the probable advantages arising from their centrical situation: And, 2. Allowing the East India Company to erect a spacious magazine in one of these islands; where also a collector, and a sufficient number of king's officers, should reside, to receive the duties of such East India commodities as might be taken off by British subjects. These he proposes for the Orkneys in particular, and in addition to improvements proposed for the whole islands in general.

The following table exhibits a view of the population of the parishes of Orkney and Shetland, at two periods.

	Parishes.	Population in 1755.	Population in 1790—1798.
	ORKNEY.		
1	Cross, Burness, &c.	1250	1389
	Dearness and St Andrews	1650	1335
	Evie and Rendall	1798	1564
	Firth and Stenness	1108	1186
5	Harray and Birsay	2200	2013
	Holm	1185	702
	Hoy and Græmsay	520	410
	Kirkwall	1089	2550
	Ladykirk	750	803
10	Orphir	855	826
	Rousay and Eglishay	978	1072
	Shapinshay	642	730
	South Ronaldshay, &c.	1996	1954
	Stromness and Sandwick	2677	3012
15	Stronsay and Eday	1493	887
	Walls and Flota	1000	991
	Westray and Papa Westray	1290	1629
	Total, Orkney	23,381	23,053
	SHETLAND.		
	Bressay and Burray	1098	1225
	Delting	1221	1504
20	Dunrossness	2295	3327
	Fitlar and North Yell	1098	1346
	Lerwick	1193	1259
	Nesting	1196	1535
	Northmaving	1009	1786
25	Sandsting	911	1285
	South and Mid Yell	986	1422
	Tingwall	1412	1786
	Unst	1368	1988
29	Walls and Sandness	1450	1723
	Total, Shetland	15,210	20,186
	Orkney	23,381	23,053
	Total	38,591	43,239
			37,591
	Increase		4648

But

In 1801, according to the returns made to Parliament, the population of Orkney was 24,445, and that of Shetland was 22,379, and in 1811 the population of both was 46,153. For a fuller account of Orkney, see Barry's History of the Orkney Islands, 4to. 1805.

ORLE, ORLET, or *Orlo*, in *Architecture*, a fillet under the ovolo, or quarter round, of a capital. When it is at the top or bottom of a shaft, it is called *cincture*. Palladio uses the word orlo for the plenith of the basis of the columns.

ORLE, in *Heraldry*. See HERALDRY.

ORLEANOIS, a province of France, now forming the three departments of Loiret, Loire et Cher, Eure et Loire.

ORLEANS, the chief town of the department of Loiret, and formerly the capital of the government of Orleanois. It was anciently called *Genabum*, or *Cenabum;* and afterwards denominated *Aurelia*, *Aureliæ*, and *Aurelianum*, by the emperor Aurelian, who considerably enlarged it. In Julius Cæsar's time it was the capital of the Carnutes. It stands about 20 leagues south of Paris, on the northern bank of the Loire; across which Mr Wraxall says there is an elegant bridge of nine arches, the entrance by which is exceedingly noble and striking, the street which leads from it being composed of most elegant modern buildings. In general, however, excepting this street, it is very meanly built; the streets are narrow, and the inhabitants in general poor. It is surrounded with walls, and fortified with 40 towers. The streets almost all terminate at the quay for the convenience of trade. It is the seat of several courts of justice, and in 1800 contained 36,000 inhabitants. It is a bishop's see; and the cathedral is a most superb Gothic structure, and had the finest steeple in France till it was damaged in the time of the civil wars. There were 22 parishes in it, and a great number of churches. There are manufactures of cloths, serges, coverlets, printed calicoes, cotton thread, painted paper, refined sugar, &c. By the canal of the Loire it carries on a considerable trade in corn, wines, brandies, vinegar, timber, fire-wood, wools, &c. The canal begins about two miles above the city; is near 18 leagues in length; and terminates on the Loing, which falls into the Seine. The environs of Orleans, more especially in the province of Sologne, to the south of the Loire, are very agreeable. It is in general a level country, covered with corn and vines. To the north of the city is a forest, the largest in the whole kingdom. Before the revolution it belonged to the duke of Orleans: to whom the timber felled in it, one year with another, brought about 100,000 livres. Louis XIV. gave the dukedom of Orleans to his own brother Philip, who began and finished the canal; which, by the duties paid by vessels going up and down, brought in, one year with another, 150,000 livres. The bishop was suffragan to the archbishop of Paris, and had a revenue of 24,000 livres, out of which his tax to Rome was 2000 florins. A new bishop, it is said, on the first day of his entering, had the privilege of releasing all the prisoners in it, except those committed for treason. In the street leading from the bridge stands the celebrated monument where Charles VII. and Joan of Arc the Maid of Orleans, are represented on their knees before the body of our Saviour, who lies extended on the lap of the Virgin. It was erected by order of that monarch in 1458, to perpetuate his victories over the English, and their expulsion from his dominions. All the figures are in iron. The king appears bareheaded, and by him lies his helmet surmounted with a crown. Opposite to him is the Maid herself in the same attitude of grateful devotion to Heaven. It is a most precious and invaluable historical monument.

"In the Hotel de Ville (says Wraxall) is a portrait of the same immortal woman, which I studied long and attentively. Though it was not done till 1581, which was near 130 years after her decease, it is yet the oldest and best picture of her now existing. The painter seems undoubtedly to have drawn a flattering resemblance of her, and to have given his heroine imaginary charms. Her face, though long, is of exceeding beauty, heightened by an expression of intelligence and grandeur rarely united. Her hair falls loosely down her back, and she wears on her head a sort of bonnet enriched with pearls, and shaded with white plumes, tied under her chin with a string. About her neck is a little collar, and lower down, upon her bosom, a necklace composed of small links. Her dress, which is that of a woman, I find it difficult exactly to describe. It sits close to the body, and is cut or slashed at the arms and elbows. Round her waist is an embroidered girdle, and in her right hand she holds the sword with which she expelled the enemies of her sovereign and her country. I am not surprised at the animated and enthusiastic attachment which the French still cherish for her memory. The critical and desperate emergency in which she appeared; her sex, youth, and even the obscurity of her birth; the unparalleled success which crowned her enterprise; the cruel and detestable sentence by which she was put to death; the air of the marvellous spread over the whole narration, increased and strengthened by that veneration which time affixes to every great event—all these united causes conspired to place her above mortality. Rome and Athens would undoubtedly have ranked her among their tutelary deities, and have erected temples to her honour; nor can I help being amazed, that amidst the almost infinite number of modern saints who crowd and disgrace their churches, no altar has yet been dedicated to the Maid of Orleans." See FRANCE, N° 101.

The bridge was new built in the 18th century, and opened in 1760; and the French esteem it the finest in the world. E. Long. 1. 59. N. Lat. 47. 54.

ORLEANS, *New*, the capital of the state of Louisiana in North America. It is situated on the left side of the Mississippi river, 105 miles from its mouth. This place was founded by the French in 1720; and since it was ceded to the United States with the rest of Louisiana in 1803, its growth has been rapid beyond example. In 1817 it was estimated to contain 30,000 inhabitants, about one third only of whom speak English. It is the great depot of trade for all the countries watered by the Mississippi, Missouri, and Ohio, and must in progress of time become one of the first trading cities in the world. The exports in 1817 amounted to 9,024,812 dollars. The low situation of the town exposes it sometimes to inundation, though it is protected by an embankment; and the extensive marshes all round render it unhealthy. The streets are

are straight, wide, and run at right angles with another. The houses are generally of wood, and built low; but some of them are very handsome and splendidly furnished. The inhabitants are a mixture of all nations, but the French and Spaniards are the most numerous classes. The style of living is luxurious and expensive. About six miles below this town a battle was fought between the British and Americans, on the 8th January 1815, in which the former were defeated with great loss.

ORLEANS, *Peter Joseph*, a French Jesuit, and author of *Histoire des Revolutions d'Angleterre*, was born at Bourges in 1641. He taught belles lettres for some time in his society, but afterwards devoted himself to the writing of history. This pursuit he continued till his death, which happened in 1698. He wrote also a history of the Revolutions of Spain; a History of Two conquering Tartars, Chunchi and Cambi; the Life of Father Coton, &c. His History of the Revolutions in England, under the family of the Stuarts, from the year 1603 to 1690, was translated into English, and published at London 1711, in one vol. 8vo.: to which is prefixed an Introduction, by Laurence Echard, M. A. who says, that "the great varieties and wonderful changes in these reigns are here judiciously comprised in a moderate volume with no less perspicuity than strictness; and with a beautiful mixture of short characters, nice reflections, and noble sentences, which render the whole agreeable and instructive. But while the reader is entertained with so much skill and fineness, we ought to caution him with relation to the education and religion of the author; for though he has great marks of a generous candour, and a laudable deference to all superiors; yet he is to be considered, in all places, as one in favour with the French king, and not only a true papist, but a complete Jesuit."

ORLOPE, in the sea language, the uppermost space or deck in a great ship, reaching from the main to the mizen mast. In three deck ships, the second and lowest decks are sometimes called *orlopes*.

ORMOND, the northern division of the county of Tipperary, in the province of Munster in Ireland. For a long time it gave the title of *earl*, and afterwards of *marquis* and *duke*, to the noble family of Butler, descended from a sister of Thomas à Becket archbishop of Canterbury; till, at the accession of George I. the last duke was attainted of high treason, and died abroad. In that part of the country the family had great prerogatives and privileges granted by Edward III.

ORMSIDE, a small town of England, near Appleby, in Westmoreland. A great number of vessels of brass, some of which seemed to have been guilt, were discovered near the manor-house, by the water washing away the soil.

ORMSKIRK, in Lancashire, in England, is a handsome town, with a good inland trade, and a population of 3064 in 1811. By the late inland navigation it has an extensive communication with the rivers Mersey, Dee, Ribble, Ouse, Trent, &c. There is a bituminous earth about this place, from which oil of amber is extracted, that preserves raw flesh, and serves the poor people instead of candles. Not far from it is Latham House, which was gallantly defended in the civil wars by Charlotte countess of Derby, who held it to the last extremity against the parliament forces, till she was relieved by Prince Rupert. It was, however, ruined in a second siege; and sold by the family to Sir Thomas Bootle, who built a very magnificent house upon it.

ORMUS, a small island of Asia, at the bottom of the gulf of the same name, at the entrance of the gulf of Persia. It is about two leagues from the main land, and about six leagues in circuit. They catch excellent oysters about the island; and it yields plenty of fine white salt; also a kind of shining black sand, which is used for dusting writings, and is transported in considerable quantity to Europe. There is neither sweet water nor grass upon it, the soil being of a salt sulphureous nature. It was taken by the Portuguese in 1507, who fortified it; and it was afterwards frequented by a vast number of merchants, who were extremely rich. In 1622 the Persians, by the assistance of the English, conquered this place, and demolished the houses, which were 4000 in number, containing 40,000 inhabitants. Some time after, the Persians rebuilt the fort, and placed a garrison in it; but they could never bring it to be a place of trade as before: however, it is the key of the Persian gulf, as well on account of the importance of the place, as the commodiousness of the harbour. It is now almost deserted, for it produces nothing but salt, which sometimes is two inches deep upon the surface of the earth. E. Long. 56. 25. N. Lat. 27. 20.

ORNE, a department of France, including part of *ci devant* Normandy and Perche. The soil is low and moist, but being well adapted for pasture, great numbers of cattle and horses are raised. There are some considerable woods, and some productive mines of iron. The trade consists chiefly in grain, cyder, cattle, horses, hemp, and in serge, woollen cloths, lace, and linens, of which there are manufactures. The territorial extent of this department is 1,265,000 arpents, or 2400 square English miles. The population in 1800 was 397,931 persons. The contributions for the year 1802 amounted to 3,666,903 francs. Alençon is the chief town.

ORNITHIÆ, a name given by the ancients to certain winds, which usually blew in the spring, at the time when the birds of passage came over to them. Pliny says, that these winds blew from the west, and that by some the Etesian winds were called by this name. Others suppose that they blew from the north, or north-west.

ORNITHOGALLUM, STAR OF BETHLEHEM; a genus of plants belonging to the hexandria class; and in the natural method ranking under the 10th order, *Coronariæ*. See BOTANY *Index*.

ORNITHOLOGY.

INTRODUCTION.

1 Definition. THE term *Ornithology* is derived from the Greek ορνις, a bird, and λογος, *discourse*, and denotes that part of Zoology which treats of birds.

Birds are two-footed animals, covered with feathers, and furnished with wings. Like quadrupeds and the cetaceous tribe, they have warm blood, a heart with two ventricles, and two auricles, and lungs for the purpose of respiration; but they are distinguished from both by their feet, feathers, wings, and horny bill, as well as by the circumstance of their females being oviparous.

2 Ornithological writers. The elegant and beautiful colouring of many of the feathered race, the graceful ease of their flight, their various music, their tender solicitude for their offspring, their engaging instincts, their susceptibility of domestication, and their subservience to the sustenance of man, have, in all ages, contributed to interest the latter in the study of their history.

3 Aristotle and Pliny. Of the naturalists, however, whose writings have descended to us from antiquity, Aristotle and Pliny are the only two who appear to have entered into any details on a subject so inviting and important. Though the former composed no particular treatise on birds, he brings them under review in different parts of his History of Animals. In the third chapter of the eighth book, for example, he enumerates the different sorts of nourishment adapted to different species, and their various modes of feeding. The ninth book contains his very imperfect nomenclature, his remarks on the diversified modes of nidification, and some valuable observations on the family of eagles. His notion of the organization and habitudes of birds are interspersed in the body of the work, and introduced in the way of comparative reference to the structure and manners of other animals. Pliny's enumeration of the feathered species, is extended over most part of his tenth book, but is destitute of precise description, and encumbered with absurdity and fable.

Of the numerous ornithologists of more modern date, some have chiefly directed their labours to method and classification, others have been more solicitous to describe and delineate; some have treated of the whole class, others of particular portions of it; while, lastly, some have been contented to define and describe, and others have illustrated and enhanced their text by more or less accurate designs from living or prepared specimens. This combination of the pen and the pencil, which has so eminently contributed, in our day, to the acquisition and diffusion of knowledge, seems to have been unknown to the ancients.

Although the unavoidable limitation of our plan precludes a minute and critical report of the works to which we have just alluded, we shall briefly advert to a few of the most conspicuous. Among the first who excited, on the continent, a taste for the study of ornithology, and for a methodical distribution of that portion of science, we may mention Belon. Aware that nature is most successfully contemplated in her own works, he travelled from the laudable desire of collecting information, and communicated to the world the results of his enquiries. His History of Birds, a thin folio volume, divided into seven books, or parts, and illustrated by wooden cuts, was published at Paris, in 1555. His principle of classification being chiefly founded on the circumstances of habitation and food, and only occasionally on external forms and characters, is obviously very defective; his descriptions, though tolerably accurate, are, for the most part, too concise; and many of his plates are very inadequate representations of their originals. It must, at the same time, be allowed, that he frequently suggests judicious views of his subject; that he notes with ingenuity, the points of resemblance between the human skeleton and that of birds; that he has penned several passages which may still be perused with interest and instruction; that the *naïveté* of his manner is always pleasing, and that when we reflect on the period in which he flourished, he is entitled to no ordinary praise. 4 Belon.

5 Gesner. The celebrated Conrad Gesner, physician and professor at Zurich, and contemporary with Belon, has devoted the third volume of his History of Animals to the department of ornithology. It is an erudite, but ponderous tome, exhibiting alphabetical tables of the names of birds, in Hebrew, Chaldee, Arabic, Greek, Latin, and most of the spoken languages of Europe. His descriptions are compiled abridgements; but his references, at the close of each article, are very numerous; for if any author of his acquaintance happen to mention a bird, his name and the passage are duly commemorated. Gesner's arrangement differs in no respect from that of any common dictionary; and few of his engravings are executed with correctness. The curious reader will probably be gratified with the perusal of his account of the art of rearing birds for falconry, the diseases to which they are liable, and the remedies which the learned doctor prescribes.

6 Aldrovandus. The same topics are discussed by Aldrovandus, a physician of Bologna, who availing himself of the writings of the two preceding naturalists, added to their indigested stores, and compiled three folios, divided into 20 books, and illustrated by wooden plates. His catalogue, however, scarcely comprises any birds but such as are natives of Europe, and by no means all even of these. He too implicitly adopts the vague distinctions of Belon; and on various occasions, not only copies Aristotle with servility, but overlays his borrowed materials with a mass of dark commentary. The motley complexion of the whole production, in fact, betrays the desire of accumulation rather than the exercise of taste and judgement.

7 Johnston. Johnston, who published in 1657 a folio volume of 160 pages, did little else than greatly condense the heavy compilements of Gesner and Aldrovandus. He divides the whole class into land and water birds, and deduces his subordinate divisions from the nature of their aliments.

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aliments. His descriptions are generally correct, but scanty; and even his figures, though traced with more character than those of his predecessors, bespeak a parsimony of engraving.

8 Willoughby.

The next writer of eminence in this department, who merits particular quotation, is Francis Willoughby, Esq. an Englishman gentleman, who laid the foundation of a more accurate arrangement. His work, which appeared in 1676, was revised and edited by his friend the celebrated Ray. It is divided into three books, of which the first is allotted to general views of the subject, and an explanation of the author's method. The first chapter treats of the form and external structure of birds, the second of their organization and internal structure. The sixth includes 24 queries, the answers to which, if founded on fact, would greatly contribute to the advancement of ornithology. Mr Willoughby formally recognizes the grand division of *terrestrial* and *aquatic*, comprising under the former those who live at a distance from water, and under the second, those which live on the margin or surface of that element. He then institutes his leading distinctions from the form of the bill and feet, and would doubtless have accomplished a more complete arrangement, had he uniformly adhered to the same principle; but in compliance with the prejudices of his time, he assumes the different kinds of food, the varieties of size, the nature of the flesh, and even moral qualities, as the grounds of subdivisions. At all events, however, he has the credit of having opened a career, which others have successfully pursued. His second and third books contain the description and history of the species, distributed according to the rules laid down in the first. To the exposition of each genus are prefixed two chapters of general observations; the first including the vague or fabulous accounts of the ancients, and the second such common properties as appertain to the genus. The author then proceeds to the specific details, stating the most important particulars with precision and neatness, and concluding with an account of peculiar habits.

9 Ray.

Ray, in his *Synopsis Avium*, follows, with a few exceptions, the method of his friend, referring at the same time to the tail feathers, and some parts of the internal conformation. The latter, we need scarcely remark, cannot with any propriety be adopted as generic or specific characters.

10 Barrere.

The new method of classing birds proposed by Monsieur Barrere in 1745, implies either a total ignorance or blameable neglect of the writings of Willoughby and Ray. As its only tendency was to confuse and perplex, we forbear noticing its details. Suffice it to remark, that it includes the peacock and man of war bird in the same family, and ranks the yellow hammer between the bustard and the ostrich. In his Essay on the Natural History of Guiana, the same author enumerates the birds in alphabetical order; but his catalogue has been more than doubled by subsequent travellers.

11 Klein.

Jacob Theodore Klein, member of several learned academies, published at Lubeck in 1750 a quarto volume, enttitled, *Historiæ Avium Prodromus, cum præfatione de ordine animalium in genere*. In this work he divides birds into families, orders, and tribes. His eight families are distinguished by the conformation of the feet, his orders by the form of the bill, and his tribes, sometimes by the form and proportions of the head, sometimes by accidental differences of the bill, and sometimes by the author's own fanciful ideas. From too great an anxiety to simplify, this naturalist is generally too brief, and adds to his obscurity by an affectation of learned phraseology.

12 Mœhring.

This last-mentioned quality likewise disfigures the scientific catalogue of Mœhring, physician to the prince of Anhalt, which appeared in 1752. His classes, orders, and genera, are founded on the formation of the feet and bill; and his descriptions of birds examined by himself, are usually accurate; but he is often misled by the errors of others, and the method which he proposes is complex and incommodious.

13 Linnæus.

In this summary of celebrated systematic ornithologists, we may assign to Linnæus the date of 1766, when he published the 12th edition of his *Systema Naturæ*. In so far as that astonishing body of arrangement respects the feathered tribes, it certainly manifests at once the extent and minuteness of the author's discriminating powers. As the same nomenclature and divisions are still the most familiar to British naturalists, we purpose to be chiefly regulated by them in the sequel, and consequently shall, for the present, wave any explanation of the Linnæan arrangement.

14 Salerne.

M. Salerne physician at Orleans, left behind him a MS. treatise on Ornithology, which was published by his friends in 1767. His method is that of Ray. The historical part is from the pen of Salerne himself; but the body of the text is a promiscuous and clumsy compilation. The typography is executed with neatness and elegance, and the plates, which are 31 in number, are engraved with uncommon skill; though the larger birds are for the most part represented on too small a scale.

15 Brisson.

M. Brisson of the Royal Academy of Sciences, published, in 1760, A System of Ornithology, in Latin and French, in six quarto volumes. He distributes birds into 26 orders, instituted from the form of the feet, bill, &c. 115 genera, which are determined by the peculiarities of the bill or mandibles, and about 1300 species. Each article is preceded by a numerous and accurate list of references and figures; many species, till then undescribed, are particularized; and the work is illustrated by upwards of 220 excellent engravings. The principal merit of Brisson's plan consists in the adoption of external and permanent characters, which enable the student to assign the name and station of a bird which he sees for the first time. The descriptions are equally accurate with those of Willoughby, and more copious. Though not exempt from errors and defects, this work still holds a respectable rank in the library of the ornithologist.

16 Buffon.

The Natural History of Birds, by the Comte de Buffon and his learned associates, is too generally known to require our analysis or criticism. Its great defect is want of scientific arrangement, a want which is scarcely redeemed even by the popular, luminous, and elegant style of the descriptions, combined with the highly finished execution of the coloured plates. With the exception, however, to which we have just alluded, we feel no hesitation in adopting the language of the English translator. "The history of birds possesses every quality that could recommend it to the public: it exhibits a clear and comprehensive view of the knowledge acquired in ornithology, scattered through a multiplicity of volumes, and

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in various languages, it discusses and elucidates with critical accuracy, the numerous controverted points; it reduces the whole to simplicity, order, and elegance; and, by large additions of valuable matter, it greatly extends the bounds of the science."—"M. de Buffon was not to be deterred by the difficulty and extent of the undertaking. The correspondents of the king's cabinet continued to transmit numerous communications, and specimens from all parts of the world. Above eighty artists were, under the direction of the younger M. Daubenton, employed five years in the drawing, engraving, and colouring, of upwards of a thousand birds. But the commencement of the work which these were intended to illustrate was delayed two years, by reason of a severe and tedious indisposition, which during that space afflicted the excellent naturalist. And after he had recovered his health, he reflected that at his advanced period of life he could not reasonably expect to be able to accomplish the history of birds, and also that of minerals, in which he had already made some advances. He judged it expedient therefore to have recourse to the assistance of his friends; and he was peculiarly fortunate in the choice of the learned and eloquent M. Gueneau de Montbeillard, who cheerfully undertook the laborious task, and composed the greatest part of the two first volumes of the History of Birds, which appeared in 1771, under the name however of M. de Buffon. In his complexion of thought and mode of expression, M. de Montbeillard followed so closely his illustrious associate, that the public could not perceive any change. It was now proper to throw off the mask; and in the publication of the four subsequent volumes, each author prefixed his name to his own articles. The third volume was nearly printed when new assistance was received from the communications of James Bruce, Esq. of Kinnaird. That accomplished and adventurous traveller, in his return from Abyssinia, passed some days with M. de Buffon at Paris. The count was filled with admiration on seeing the numerous and elegant drawings which Mr Bruce had made of natural objects; and on several occasions he mentions the explorer of the source of the Nile in terms the most flattering and respectful. After the publication of the sixth volume in 1781, M. de Montbeillard was desirous of devoting the whole of his leisure in composing the History of Insects, which had become his favourite study. The three remaining volumes were therefore written by M. de Buffon himself; though he acknowledges that the Abbé Bexton had collected the nomenclature, formed most of the descriptions, and communicated several important hints. The work was completed in 1783; and as only a few copies of the illumined plates were on sale, and these extremely costly, a small set of engravings were made, to accommodate ordinary purchasers."

Sonnini's recent edition of Buffon's Natural History contains many valuable additions; and forms, perhaps, one of the most complete works of the kind that has yet appeared. In the department of ornithology, it presents us with descriptions and figures of every bird to which the editors could have access, either in the living or preserved state, or of which they could be favoured with drawings.

17 Mauduyt. Mauduyt's Dictionary of Ornithology, which makes part of the *Encyclopédie Méthodique*, deserves to be particularly quoted, on account of the preliminary discourses, the accuracy of the descriptions and references, and the correct execution of the plates. The whole forms an excellent collection of the most important particulars which lay within the author's reach; and we have occasionally availed ourselves of his labours in the compilement of the present article.

A series of splendid plates was executed at Florence, in illustration of Gerini's Ornithology; but they betray, in general, a disregard of nature, and are, in many instances, merely copied from imperfect drawings or inaccurate engravings. Gerini's nomenclature is likewise very faulty, and too frequently confounds species and varieties. 18 Gerini.

In 1773, the ingenious and indefatigable Mr Pennant published a small volume, entitled *Genera of Birds*. In his preface, he enters into a minute account of the external parts of birds, their feathers, flight, nidification, &c. In his selection of systematic arrangement, he gives the preference to that of Ray, whose plan appears to him to be so judicious, that it is scarcely possible to make any change in it for the better. At the same time, he admits, that latter discoveries had made a few improvements on his labours. "My candid friend, Linnæus," adds Mr Pennant, "will not take it amiss, that I in part, neglect his example; for I permit the *land-fowl* to follow one another, undivided by the *water-fowl* with pinnated feet, placing them between the *waders* or *cloven-footed* water-fowl, and the web-footed. The *ostrich*, and land-birds with wings useless for flight, I place as a distinct order. The *trumpeter* (*Psophia Linnæi*) and the *bustards*, I place at the end of the gallinaceous tribe. All are land-birds. The first *multiparous*, like the generality of the gallinaceous tribe; the last granivorous, swift runners, avoiders of wet places; and both have bills somewhat arched. It must be confessed, that both have legs naked above the knees, and the last, like the *waders*, lay but few eggs. They seem ambiguous birds, that have affinity with each order; and it is hoped, that each naturalist may be indulged the toleration of placing them as suits his own opinion." Mr Pennant's grand divisions, then, are into *land-birds* and *water-fowl*. The first he distributes into the six following orders. 1. *Rapacious*, 2. *Pies*, 3. *Gallinaceous*, 4. *Columbine*, 5. *Passerine*, and 6. *Struthious*. The second comprehends, 7. *Cloven-footed*, or *Waders*, 8. those with *Pinnated feet*, and 9. the *Web-footed*. 19 Pennant.

In 1781, Dr Latham commenced his *General Synopsis of Birds*, a work of much accurate detail, and extending to three double quarto volumes, with two of supplement. Admitting the primary division of Ray, he adheres, with a few exceptions, to the Linnæan genera, which, as well as the species, his opportunities of research enabled him to multiply to a very considerable amount. Each genus is illustrated by one coloured copperplate at least, usually of some rare species. Of these plates, however, the execution is sometimes coarse or meagre; and candour will not permit us to compliment the author on the purity or correctness of his style. His volumes, nevertheless, constitute a precious repository of descriptions and facts, and must always hold a distinguished place in the library of the ornithologist. Dr Latham is likewise the author of an *Index Ornithologicus*, which forms a convenient compend of his larger work, being comprised in two quarto volumes. 20 Latham.

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21 Gérardin. About two years ago, Sebastian Gérardin de Mirecourt published an "Elementary View of Ornithology, or the Natural History of those Birds which usually occur in France," &c. This gentleman appears to have been born and bred in the department of the Vôges, in which he discharged the duties of professor of natural history, and which is known to contain a greater diversity of the feathered race than almost any province in Europe. His preliminary discourse explains the general topics of ornithology in language at once succinct and perspicuous. The five chapters of which it consists were submitted to the revision of the estimable Daudin, whose premature death his friends and science will long deplore. The arrangement of the work, which is limited to two octavo volumes, and a thin quarto volume of plates, has been chiefly regulated by that of Cuvier, in his Sketch of the Natural History of Animals; but M. Gérardin has ventured to introduce a few occasional alterations, which were suggested in the course of his teaching in the central school, and which he conceived would facilitate the progress of his pupils. His synonymy is that of Linnæus and Brisson; and his descriptions are generally minute, distinct, and accurate. On the whole, however, the reader is entitled to expect more copious information relative to the manners and habits of many of the species, than will be found in these results of thirty years application to the subject, combined with many favourable opportunities. We have also remarked a want of uniformity and precision in some of the author's statements. The engravings are chiefly valuable on account of the correctness of their outlines.

22 Hernandez. Of the numerous writers who have treated of the birds of particular countries, we may observe, that Hernandez, a Spanish physician, has described those of Mexico. His work consists of 229 chapters, each of which, generally, treats of a single species. As they are, however, designed only by their Mexican names, and described with too much brevity, their precise stations in the Linnæan arrangement are with difficulty ascertained.

23 Nieremberg. Similar objections apply to the work of Nieremberg, who has described the birds of the same country. From both we may infer, that the feathered tribes in Mexico are numerous, and diversified with the most brilliant colouring; and that the natives had made considerable progress in the study of their history.

24 Marcgrave. Brazil presents a still more rich and splendid field to the researches of the ornithologist; but Marcgrave, who professes to delineate its natural history, and allots his fifth book to the birds, is not less defective than the two writers whom we have just mentioned. His plates are not only wretchedly executed; but frequently do not correspond with the descriptions.

25 Sloane. Sir Hans Sloane, in his History of Jamaica, has represented 44 species of birds, in 18 plates, annexed to the second volume; but it is seldom that the reader can rely on the accuracy of his delineations.

29 Catesby. To Mr Catesby of the Royal Society, we are indebted for an excellent account of the birds of Carolina, Florida, and the Bahama islands, in two volumes imperial folio, in French and English. The first volume, and part of the appendix in the second, are devoted to the birds. The descriptions are concise and perspicuous, and accompanied with some interesting notices relative to the manners and habits of the species described. The plates, which are numerous, are generally faithful representations of the originals, and admirably well coloured. The method followed in these splendid volumes, approaches somewhat to that of Willoughby.

27 Schwenckfel. Schwenckfel a physician, who published in 1603 a natural history of Siberia, in two quarto volumes, includes the birds in his fourth book. His enumeration and description of the parts which belong to birds in common with other animals, and of the appropriate parts of the organization of the former, are neat and accurate. His differences, founded on habitation, food, &c. are less valuable. The introduction is followed by the enumeration of birds, in alphabetical order, according to their Latin names. The descriptions, though accurate, are, for the most part, too short; and though adequate to recall a bird already known, are not sufficient to convey a precise notion of those which are described for the first time. The historical portion is too much condensed; and with facts which are calculated to excite interest, the author often blends such as are superfluous, or improbable.

28 Brunnich. M. Brunnich published in 1764, an account of the birds of Denmark, and the neighbouring islands and provinces. In most instances he follows the Linnæan nomenclature, and sometimes the synonymy of Brisson. He chiefly dwells on the rare and non-descript species, but even then seldom enters sufficiently into detail, to enable the student to ascertain the species in question.

29 Sonnerat. M. Sonnerat, corresponding member of the Royal Academy of Sciences of Paris, published, in 1776, an account of his voyage to New Guinea, the Molucca and Philippine islands, the isle of France, and some other islands, in the Indian ocean; and in 1783, he favoured the world with a relation of his second voyage, to several parts of the East Indies and China. Though this zealous and learned naturalist was prevented by want of time, from forming very extensive collections, his descriptions and designs manifest both accuracy and taste. Besides correcting the errors of former travellers and voyagers, he has noticed a considerable number of birds for the first time, and most of them remarkable either for their singularity or beauty. His account of the wild cock and hen, the origin of our common domestic fowl, will be perused with peculiar interest.

30 Frisch. The splendid work of Frisch, a German naturalist, chiefly consists of coloured plates of the birds of Europe, arranged in 12 classes according to distinctions which are sometimes vague and incommodious. The figures are, for the most part, accurate and lively representations from nature, though in some instances, they are larger than the life. The author has bestowed particular attention on the different colourings of the two sexes of the same species.

31 Le Vaillant. M. le Vaillant, author of a voyage to the Cape of Good Hope, and of the natural history of the birds of Africa, is eminently distinguished by the ardour and acuteness with which he has prosecuted his ornithological researches, and has availed himself with laudable diligence of his rare opportunities of collecting accurate details relative to every species which he undertakes to illustrate. His natural history of the birds of paradise, rollers, promeropes, toucans, and barbets, is perhaps the most highly finished and sumptuous publication that has appeared in any of the departments of ornithology. The figures, about one hundred in number, are engraved by Pérée, from the drawings of Barraband, coloured by Langlois,

Introduction. Langlois, and retouched by the pencil of the original designer; while the elder Didot has executed the typography, in his best style, on vellum paper. Each figure is as large as life, and is usually drawn from a specimen in the highest state of preservation; and in many cases, an exact representation of the female bird has also been obtained. Though the pre-eminent merit of the work consists in the figures and descriptions, it is in a few instances agreeably diversified by traits of character, which the author remarked in the living bird, and by some interesting hints of a more general complexion, which his accurate and extensive observation enabled him to collect. We cannot, however, refrain from expressing a wish, that he had been more liberal of his synonyms and references, and that he had treated systematic writers with a little more respect. We should not forget, that methodical nomenclature, though the result of art, and liable to many errors, is entitled at least to subordinate regard, and as an unspeakable aid to the memory. Even if we should concede to our innovating author the propriety of those more fanciful arrangements to which he manifests a predilection, it would still admit of doubt, whether, on the whole, they would more accord with gradations unequivocally indicated by nature. Are we certain that, amid her countless productions, nature recognizes a single line of demarcation? or, that the study of ornithology would be essentially promoted by classing the sifilet with the jays, or every individual furnished with parade feathers among birds of paradise?

32 Desmarest. The natural history of tanagers, todies, and manakins by Anseline Gaëtan Desmarest, with coloured engravings, from drawings by Paulina de Courcelles, pupil of Barraband, is another of those recent and splendid productions of the Parisian press, which reflect so much honour on the zeal, industry, and taste of the French naturalists. The paper, type, and figures, all bespeak the excellence of the respective artists who have produced them, as well as the love of chaste and elegant embellishment which has presided over the undertaking. The ornamental style of the work, however, is not its sole passport to our favourable notice. The exposition of the three genera mentioned in the title, is a subject which calls for much critical research and laborious investigation. M. Desmarest, without presuming to extricate the whole nomenclature, lays down many important distinctions, and proceeds with circumspection, so far as his opportunities have enabled him to advance. "Before we enter," says he, "on the details of the species, it may be proper to mention, that we shall limit our descriptions to those which we have seen, and of which we have been enabled to exhibit figures. We shall, moreover, endeavour to analyse, and, if possible, to unravel the references of authors. Should success thus far attend us, we conceive that we shall have duly performed the part of zealous naturalists." Besides descriptions and plates of the male, the author has also, not unfrequently, represented the female, or young of the same species, or an individual as it appears in the moulting state. His pages will afford least entertainment to those, who delight to observe the instincts and economy of the feathered race; and who shrink from the minute adjustment of classification and synonymy. It ought, however, to be remembered that few authentic facts have been collected relative to the history of these foreign birds; and that though future travellers may increase the scanty stock of interesting notices, the exertions of the present author may not a little contribute to systematize and facilitate their observations.

The Natural History of Birds, by George Edwards, in four quarto volumes, without any reference to country or method, contains many excellent coloured designs and correct descriptions; and the same remark applies to his Gleanings of Natural History, the most considerable portion of which relates to birds. 33 Edwards.

Several of his countrymen have expounded or delineated the birds of our own island with more or less felicity of manner. The ornithological part of Pennant's British Zoology, Hayes's Natural History of British Birds, with their portraits accurately drawn, and beautifully coloured from nature; Lard's Natural History of British Birds, Lewin's Birds of Great Britain, with their eggs, in three volumes quarto, Walcott's Synopsis of British Birds, two volumes 4to, Bewick's History of British Birds, with figures engraved on wood, &c. &c. are all entitled to critical notice; but the limitation of our plan forbids us to dwell on them. We shall, therefore, close this portion of our introduction by pointing to a work which seems not yet to have procured its due share of the public favour; we mean the Ornithological Dictionary, or Alphabetical Synopsis of British Birds, by George Montagu, F. L. S. &c. in two small octavo volumes. We are acquainted with few publications of the kind that contain a larger quantity of accurate and important information within such a narrow compass. As a book of reference and consultation, it is well calculated to suit the occasions of ordinary readers, and even to convey instruction to the learned student. The synopsis and specific descriptions evince much diligence and accuracy; and various articles are enriched by the result of personal observation and extensive travel. Sufficiently aware of the fallible indications of plumage, the writer is more solicitous to reduce than to multiply distinctions; and in doubtful cases, has sometimes had recourse to the unequivocal test of dissection. A few of the articles, however, are dismissed with too much brevity, and the style is very deficient in polish and correctness. 34 British ornithologists. 35 Montagu.

If any of our readers are desirous of procuring a more complete catalogue of works published on ornithology prior to the year 1760, they will find it in Gronovius's *Bibliotheca regni animalis atque lapidei, ac recensio auctorum et librorum qui de regno animali et lapideo, methodicè, physicè*, &c. *tractant.*

The structure of the feathered tribes, and their habits of life, are wonderfully adapted to the various functions which they are destined to perform. The pointed beak, the long and pliant neck, the gently swelling shoulder, the expansive wings, the tapering tail, the light and bony feet, are all wisely calculated to assist and accelerate their motion through the yielding air. Every part of their frame is formed for lightness and buoyancy; their bodies are covered with a soft and delicate plumage, so disposed as to protect them from the intense cold of the atmosphere through which they pass; their wings are made of the lightest materials, and yet the force with which they strike the air is so great, as to impel their bodies forward with astonishing rapidity, while the tail serves the purpose of a rudder to direct them to the different objects of their pursuit. The internal structure of birds is no less wisely adapted to the 36 General observations on birds. 37 Suitable conformation.

same purposes; all the bones are light and thin, and all the muscles, except those which are appropriated to the movements of the wings, are extremely light and delicate. The lungs are placed close to the backbone and ribs. The air, entering into them by a communication from the windpipe, passes through, and is conveyed into a number of membranous cells which lie on the sides of the pericardium, and communicate with those of the sternum. In some birds, these cells are continued down the wings, and extended even to the pinions, thigh bones, and other parts of the body, which can be filled and distended with air at the pleasure of the animal. The feathers, too, and particularly those of the wings, contain a great quantity of air. The almost universal diffusion of this fluid in the bodies of birds is of infinite use to them, not only in their long and laborious flights, but likewise in preventing their respiration from being stopped or interrupted by the rapidity of their motion through a resisting medium. Were it possible for man to move with the swiftness of a swallow, the actual resistance of the air, as he is not provided with internal reservoirs similar to those of birds, would soon suffocate him.

38 Nutrition.

Birds, like quadrupeds, may be divided into granivorous and carnivorous. The former are furnished with larger intestines than those of the latter. Their food, which consists of grain of various sorts, is conveyed entire into the first stomach, or craw, where it undergoes a partial dilution by a liquor secreted from the glands, and spread over its surface. It is then received into another species of stomach, where it is farther diluted, after which it is transmitted into the gizzard, or true stomach, consisting of two very strong muscles, externally covered with a tendinous substance, and lined with a thick membrane of prodigious power and strength, in which organ the food is completely triturated, and prepared for the operation of the gastric juices. In order to ascertain the strength of these stomachs, Spallanzani had recourse to a great variety of ingenious experiments. Tin tubes, full of grain were forced into the stomachs of turkeys, and, after remaining 20 hours, were found to be broken, compressed, and distorted in the most irregular manner. In the space of 24 hours, the stomach of a cock broke off the angles of a piece of rough jagged glass, though, on examining the gizzard, no wound or laceration appeared. In a ball of lead, were fixed 12 strong needles, with the points projecting about a quarter of an inch from the surface. Thus armed, the ball was covered with a case of paper, and forced down the throat of a turkey. The bird retained it a day and a half without manifesting any symptoms of uneasiness, and the points of all the needles were broken off close to the surface of the ball, except two or three, of which the stumps projected a little. The same interesting observer relates, that he fixed 12 small and very sharp lancets, in a similar ball of lead, which was given in the same manner to a turkey cock, and left eight hours in the stomach, at the expiration of which the organ was opened; but nothing appeared except the naked ball, the lancets having been broken to pieces, and the stomach remaining sound and entire. Hence we may infer, that the stones so often found in the stomachs of many of the feathered tribes, may powerfully contribute to the comminution of grain and other hard substances which constitute their food.

Granivorous birds partake much of the nature and disposition of herbivorous quadrupeds, agreeing with them in the number of their stomachs, the comparative length and capacity of their intestines, the quality of their food, and the gentleness of their manners. Contented with the seeds of plants, with fruits, insects, and worms, their principal attention is directed to procuring food, hatching and rearing their offspring, and eluding the snares of men and the attacks of predaceous animals. As they are generally tractable and easily domesticated, man has selected for his own advantage those which are most prolific and profitable. Of these the hen, goose, turkey, and duck, are the most considerable, and form a valuable store of rich, wholesome, and nutritious food.

Carnivorous birds are provided with wings of great length, the muscles which move them being proportionally large and strong, so that they are enabled to keep long on the wing, in search of their prey. They are, besides, armed with strong hooked bills, and sharp and formidable claws. They have large heads, short necks, strong and brawny thighs, and a sight so acute and piercing, as to enable them to view their prey from the greatest heights in the air, and to dart down on it with incredible swiftness and undeviating aim. Their stomachs are smaller than those of the granivorous kinds, and their intestines are much shorter. The analogy between carnivorous birds and quadrupeds, is too obvious to escape the notice of even the superficial observer. Both of them are provided with weapons which indicate destruction and rapine, their manners are fierce and unsocial, and they seldom congregate, like the inoffensive granivorous tribes; but when not on the wing, retire to the tops of sequestered rocks, or to the depths of extensive forests, where they conceal themselves in sullen and gloomy solitude. Such of them as feed on carrion, have the sense of smelling so acute, that they can scent carcases at astonishing distances.

39 Flight and migration.

Without the means of conveying themselves with great swiftness from one place to another, birds could not easily subsist, the food which nature has provided for them being so irregularly distributed, that they are obliged to take long journeys to distant parts in order to procure the necessary supplies. Hence one cause of those migrations which are so peculiar to the feathered race. Besides the want of food, however, two other causes may be assigned, namely, the want of a proper temperature of air, and of a convenient situation for the important work of breeding and rearing their young. Such birds as migrate to great distances, are alone denominated *birds of passage*; but most species are more or less so, although they do not move to places remote from their former habitations. At particular periods of the year, most birds remove from one country to another, or from the more inland districts towards the shores, or *vice versa*. The seasons of these migrations are observed with the most astonishing order and punctuality; but the secrecy with which immense flocks take their departure, and the suddenness with which they reappear, are not easily explained. We are also apt to suppose, that, during long flights over immense tracts of water, the means of subsistence would inevitably fail, without reflecting on the superior velocity with which birds are carried forward in the air, and the ease with which they continue their exertions for a much longer

longer time than can be done by the strongest quadruped. Our swiftest horses are supposed to go at the rate of a mile in somewhat less than two minutes; and there is one instance on record of a horse that went at the rate of nearly a mile in one minute, but only for one second of time. In such cases an uncommon degree of exertion has been attended with its usual consequences, debility, and a total want of power to continue that exertion; but the motions of birds are not impeded by similar causes, and they not only glide through the air with a quickness superior to that of the swiftest quadrupeds, but can continue on the wing with equal speed for a considerable length of time. Now, if we can suppose a bird to go at the rate of only half a mile in a minute, for the space of 24 hours, it will, in that time, have gone over an extent of more than 700 miles; which is sufficient to account for almost the longest migration; and, if aided by a favourable current of air, there is reason to believe, that it will perform the same journey in a much shorter space of time.

The wings of birds are so constructed, that, in striking downwards, they expand very considerably, and, except that they are somewhat hollow on the under side, they form, in this act, almost two planes. The muscles that move the wings downwards are very large, and have been estimated, in some instances, at not less than the sixth part of the weight of the whole body. When a bird is on the ground, and intends to fly, it takes a leap, stretches its wings from the body, and strikes them downwards with great force. By this stroke, they are put into an oblique direction, partly upwards, and partly horizontally forwards. That part of the force which tends upwards is destroyed by the weight of the bird, while the horizontal impulse serves to carry it forwards. The stroke being completed, it moves its wings; and they, being contracted, and having their edges turned upwards, meet with very little resistance from the air. When they are sufficiently elevated, it makes a second stroke downwards, and the impulse of the air again moves it forward. These successive strokes act as so many leaps taken in the air. When the bird wants to turn to the right or left, it strikes strongly with the opposite wing, so as to impel the body to the proper side. If it wants to rise, it raises its tail, and if to fall, depresses it. When in a horizontal position, the tail keeps the body steady. A bird, by spreading its wings, can continue to move horizontally in the air for some time, without striking, because it has acquired a sufficient velocity; and the wings, being parallel to the horizon, meet with but small resistance. On alighting, it expands its wings and tail full against the air, that they may meet with all possible resistance. The centre of gravity in birds is somewhat behind the wings; and, to counterbalance it, most of them may be observed to thrust out their head and neck in flying. This is very apparent in the flight of ducks, geese, and several species of water-fowl, whose centre of gravity is farther backwards than in the land birds. In the heron, on the contrary, whose long head and neck, although folded up in flight, overbalance the rest of the body, the long legs are extended, in order to give the proper counterpoise, and to supply what is wanting in the shortness of the tail.

40

Lubrication of the feathers.

The feathers of birds would constantly imbibe the moisture of the atmosphere; and, during rain absorb so much wet, as would almost, if not wholly, impede their flight, had not the wise economy of nature obviated this by a most effectual expedient. They are furnished on the rump with two glands, in which a quantity of unctuous matter is constantly secreting. This is occasionally pressed out by means of the bill, and used for the lubrication of the feathers. The birds which share, as it were, the habitations of man, and live principally under cover, do not require so large a supply of this fluid, and, consequently, are not provided with such a large stock of it as those that rove abroad, and reside in the open element. Hence poultry, when wet, assume a ruffled and uncomfortable appearance.

41

Nictitating membrane.

As birds are continually passing among hedges and thickets, their eyes are protected from external injuries, as well as from too much light, when flying in opposition to the sun's rays, by a nictitating or winking membrane, which can at pleasure be drawn over the whole eye like a curtain. This covering is neither opaque, nor wholly pellucid, but somewhat transparent. By means of it the eagle is said to gaze at the sun.

42

Song.

It appears from observations, founded on numerous experiments, that the peculiar notes, or song, of the different species of birds, are altogether acquired, and are no more innate than language is in man. The attempt of a nestling to sing, may be compared with the imperfect endeavour of a child to talk. The first essay seems not to possess the slightest rudiments of the future song; but, as the bird grows older and stronger, it is not difficult to perceive its aim. While the scholar is thus endeavouring to form his song, when he is once sure of a passage, he commonly raises his tone, which he drops again when he is not equal to what he is attempting. A common sparrow, taken from the nest when very young, and placed near a linnet and goldfinch, though in a wild state it would only have chirped, adopted a song that was a mixture of these two. Three nestling linnets were educated, one under a skylark, another under a wood-lark, and a third under a tit-lark; and, instead of the song peculiar to their own species, they adhered entirely to that of their respective instructors. A linnet, taken from the nest, when but two or three days old, and brought up in the house of an apothecary at Kensington, from want of other sounds to imitate, almost articulated the words "pretty boy," as well as some other short sentences. These and other well-authenticated facts seem to prove, that birds have no innate notes, but that the language of those to whose care they are committed at birth, will be the language which they adopt in after life. It may, however, appear somewhat unaccountable why, in a wild state they adhere so steadily to the song of their own species only, when so many others are to be heard around them. This arises from the attention paid by the nestling bird to the instructions of its own parent only, generally disregarding the notes of all the rest. Persons, however, who have an accurate ear, and have studied the notes of different birds, can very often distinguish some that have a song mixed with those of another species; but these are in general so trifling as scarcely to be reckoned any thing more than mere varieties of provincial dialects.

34

Eggs.

All birds are oviparous, or produce eggs, from which, after the process of incubation, the young are extruded. These eggs differ in different species, in respect of number, figure and colour. They contain the rudiments

Introduction. rudiments of the future young, for the maturation of which a bubble of air is always placed at the large end, betwixt the shell and the inside skin. It is supposed, that, from the warmth communicated by the sitting bird to this confined air, its spring is increased beyond its natural tenor, and at the same time its parts are put into motion by the gentle rarefaction. Hence pressure and motion are communicated to the parts of the egg, and seem, in some unknown way, gradually to promote the growth of the young till the appointed time of exclusion. Housewives, when they suspect an egg is not good, put their tongue to the great end, to feel if it be warm. If that is not the case, it is considered a certain proof, that the air, having by degrees effected its escape, the egg is at length become putrid or addled.

44 Nests. The nests of birds are, in general, constructed with astonishing art, and with a degree of skill and neatness that often defies the efforts of the human hands. Both the male and female generally assist in this interesting concern. They each bring materials to the place, as sticks, moss, straws, &c. for the foundation and exterior; and hair, wool, or the down of animals or plants, to form a soft and commodious bed for their eggs, and for the tender bodies of their young when hatched. The outside of the nest usually bears so great a resemblance in colour to the surrounding foliage or branches, as not easily to be discovered even by persons who are in search of them.

45 Age. The term of life varies greatly in birds, and does not seem to bear the same proportion to the time of acquiring their growth as has been remarked with regard to quadrupeds. Most birds acquire their full dimensions in a few months, and are capable of propagation the first summer after they are hatched. In proportion to the size of their bodies, they possess more vitality, and live longer, than either man or quadrupeds. Notwithstanding the difficulties which arise in ascertaining the ages of birds, there are instances of great longevity in many of them, particularly geese, swans, ravens, and eagles, which have been known to attain the age of seventy, fourscore, or even a century. Pigeons usually live more than 20 years, and even linnets and other small birds have been kept in cages for nearly the same period.

46 Diseases. The diseases to which birds, in their natural state, are incident, are probably neither numerous nor formidable; at least we seldom meet with individuals of the feathered race which seem to labour under sickness or infirmity. In our northern latitudes they are indeed frequently subjected to the pressure of cold and hunger; but the debility and other symptoms attendant on these external accidents, hardly deserve to be noticed in a nosological point of view. Seclusion from the open air, and a total change of habits, induced by confinement and domestication, are usually accompanied by appropriate disorders, such as the pip, or swelling on the extremity of the tongue, a softening of the bill, a gradual decay of the feet, convulsions, and general pining. The moulting process, from which none of the species are exempted, may also be regarded, in some measure, as a diseased state of the animal. All birds moult, or cast their feathers once, and some twice, in the course of a year. This change takes place in autumn, or in the season which corresponds to it in different climates, and uniformly after the breeding season. Those which moult twice a year, also change their feathers in spring. Most of the young males, which bear originally the plumage of the mother, assume, at their first moulting, the colouring which they afterwards retain; but some species do not put on their characteristic garbs till the end of the second, or even of the third year. Among those which moult twice a-year, both males and females change their plumage; but the latter retain the same markings, while the former exhibit a more gaudy covering in the season which precedes their pairing, and a more sober one, often similar to that of the female, after the period of breeding. In most cases, the feathers fall off in gradual succession; but in some species nearly the whole plumage comes off at once, and is speedily replaced. This periodical affection is always attended with more or less languor and depression.

47 Anatomy. For the anatomy of birds, we beg leave to refer to the article *Comparative* ANATOMY; and shall close this introduction by a brief explanation of some of the most important technical terms in ornithology, employed by Pennant and Linnæus. 48 Technical terms.

Plate CCCXCII. fig. 1.

Fig. 1. *Cere* (*Cera*, Lin.),—the naked skin which covers the base of the bill in the hawk kind.

2. *Capistrum*,—a word used by Linnæus to express the short feathers on the forehead just above the bill. In some birds, these feathers fall forward over the nostrils: they quite cover those of the crow.

3. *Lore* (*Lorum*, Lin.),—the space between the bill and the eye, generally covered with feathers; but, in some birds, as in the black and white grebe, naked.

4. *Orbits* (*Orbita*, Lin.),—the skin that surrounds the eye, which is generally bare, particularly in the heron and parrot.

5. *Emarginated* (*Emarginatum*),—said of a bill which has a small notch near the end, as that of the butcher bird, thrush, &c.

6. *Vibrissæ pectinatæ*,—stiff hairs which grow on each side of the mouth, formed like a double comb, as in the goatsucker, flycatcher, &c.

7. *Alula spuria*, *Spurious* or *bastard wing*,—a small joint rising at the end of the middle part of the wing, or the *cubitus*, on which there are three or five feathers.

8. *Tectrices primæ*, *Lesser wing-coverts*,—the small feathers which lie in several rows on the bones of the wings. The under coverts are those that line the inside of the wings.

9. *Tectrices secundæ*, *Greater coverts*,—the feathers, which lie immediately over the quill-feathers and the secondaries.

10. *Primores*, *Quill-feathers* or *Primaries*,—the largest feathers of the wings, or those that rise from the first bone.

11. *Secundariæ*, *Secondary feathers* or *Secondaries*,—those that rise from the second bone.

12. *Tail-coverts* (*Uropygium*),—those which cover the base of the tail on the upper side.

13. *Vent-feathers* (*Crissum*),—those which lie from the vent to the tail underneath.

14. *Rectrices*, *Tail-feathers*.

15. *Scapulares*, or *Scapular feathers*,—those which take their rise from the shoulders, and cover the sides of the back.

16. *Nucha*.—the hind part of the head

17.

Introduction.

17. *Subulatum, Subulated* or *awl-shaped*,—applied to a bill that is straight and slender, in the form of an awl.

18. *Pes ambulatorius*,—all the toes divided to the bottom.

19. *Pes gressorius*,—the outer toe more or less united to the middle one, particularly conspicuous in the feet of the king's fisher.

20. *Pes scansorius*,—formed for climbing, like the foot of the woodpecker.

21. *Pes lobatus*,—finned, or lobed, like those of the grebes.

22. *Pes pinnatus*,—pinnated, or scolloped. The webs indented in the sides, as in coots and sandpipers.

23. *Pes tridactylus*, or *cursorius*,—wanting the back toe.

24. *Pes didactylus*,—composed of only two toes, as in the ostrich.

25. *Pes semi-palmatus, Semi-palmated*,—when the webs reach only half the length of the toes.

26. *Ungue postico sessili*,—when the hind claw adheres to the leg without any toe, as in the petrels.

27. *Digitis quatuor omnibus palmatis*,—all the four toes connected by webs, as in the corvorant.

Rostrum cultratum,—when the edges of the bill are very sharp, as in that of the crow.

28. *Unguiculatum*,—said of a bill furnished with a nail at the end, as those of ducks and goosanders.

29. *Lingua ciliata*,—a tongue edged with fine bristles, like that of the duck.

30. *Integra*,—plain, or even.

31. *Lumbriciformis*,—when the tongue is long, round, and slender, like a worm, as that of the woodpecker.

Pedes compedes,—when the legs are placed so far behind as to make the bird walk with difficulty, or as if in fetters, of which we have examples in the auks, grebes, and divers.

32. *Nares lineares*,—when the nostrils are very narrow, as in sea gulls.

33. *Emarginatæ*,—with a rim round the nostrils, as in the stare.

Iris, is that part which surrounds the pupil of the eye.

Mandibles, denote the upper and under parts of the bill.

Compressed,—vertically flattened at the sides.

Depressed,—horizontally flattened.

Caruncula,—a fleshy excrescence on the head.

Hypochondria,—the hinder sides of the breast and abdomen.

Ocellated,—with roundish concentric spots, of different colours.

Phalanges,—the articulations of the toes.

SYSTEMATIC EXPOSITION OF THE CLASS.

49 Orders.

ACCORDING to the Linnæan method, the class of *Aves*, or *Birds*, is distributed into six *Orders*, denominated *Accipitres, Picæ, Anseres, Grallæ, Gallinæ*, and *Passeres*.

50 Accipitres.

Order I. ACCIPITRES.

This natural order includes birds of prey, that have the bill somewhat hooked downwards, the upper mandible dilated near the point, or armed with a tooth, the nostrils wide, the feet short and strong, with four toes, three of which are placed forwards, and one behind; toes warty under the joints; claws hooked and sharp-pointed. They live on other animals alive or dead, and are themselves not eatable. They are monogamous, or live in pairs. The females are larger and more beautiful than the males, and generally lay about four eggs. This order includes *vultur, falco, strix*, and *lanius*.

51 Vulture.

Gen. 1. Vultur, *Vulture*.

52 Characters.

Bill straight, hooked at the point; head bare of feathers.

Birds of this genus are distinguished from eagles and hawks, by being gregarious, by the comparative heaviness of their flight, and by their living on carrion. The females, too, are hardly larger than the males. Unless pressed by hunger, they seldom attack living animals; they fly slowly, unless when very high in the air, and have an exquisite sense of smell. The tongue is large and fleshy; the legs and feet are strong, and mostly covered with scales; and the wings are lined, on the inside, with down.

53 Gryphus.

Condor, condur, or *cuntur*.—Very large, with a caruncle on the crown of the head, the whole of its length; the throat naked. Quills of the wings two feet and a half long, and an inch and a half thick; body black, back white; neck ruffed with long white feathers; throat red; head brown, and woolly; eyes black, irides chesnut; bill black, but tipt with white; feet black; claws straightish; tail small.—The female differs from the male, in having a tuft on the neck, in its brown colour, and in having no ruff. Brisson, however, has properly remarked, that the plumage of this species varies in colour, a circumstance which will, in some measure, account for the discordant descriptions of different authors. At the same time, we must regret, that the history of this enormous bird is so imperfectly known. Its extent of wing is variously stated, from nine to eighteen feet; and, while Fresier ascribes to it sufficient strength to carry off sheep, and boys of ten years old, Marco Paolo sturdily affirms, that it can lift an elephant from the ground high enough to kill it by the fall. Though very rare, Buffon suspects that it is not confined to South America, and that it does not essentially differ from the *roc* of the eastern nations, so famous in the Arabian tales; nor from the *laemmer geyer* of the German Alps. A preserved specimen in the Leverian Museum measured ten feet, from the tip of one wing to that of the other. It is described and figured in the second supplement to Latham's Synopsis. In Chili, the condors make their nests among the most inaccessible rocks, and lay two white eggs bigger than those of a turkey. They feed on dead carcases, and sometimes prey on sheep, goats, or even young calves, when they stray far from their dams, falling on them in flocks, plucking out their eyes, and tearing them in pieces. The country people

Accipitres. use every means to destroy such formidable invaders of their property, and seem to have succeeded in expelling them from the populous districts of both continents.

54 *Papa.* *King vulture*, or *king of the vultures*.—Caruncles on the nostrils; crown of the head and neck bare of feathers. The extreme length of the body does not exceed two feet three inches, and it is not thicker than the hen turkey. Its wings are short in proportion to the other vultures. The bill is thick and short, and begins its curvature only at the point; in some individuals it is entirely red, in others only red at the extremity, and black in the middle. In the cere, which is broad and orange-coloured, are placed the nostrils; and between them the skin projects like a loose jagged comb, falling indifferently on either side, according as the bird moves its head. Under the naked part of the neck is a collar, or ruff, composed of pretty long soft feathers of a deep ash colour, and so broad, that when the bird contracts itself, it can conceal the neck and part of the head like a cowl, whence some naturalists have given it the name of *monk*. The feathers on the breast, belly, thighs, legs, and under the surface of the tail, are white, slightly tinged with yellow; those of the rump and upper surface of the tail, are black in some individuals, and white in others. The other feathers of the tail are always black, and so are the great feathers of the wings, which are commonly edged with grey. The king of the vultures is a native of South America and the West Indies, and lives on carrion, rats, lizards, snakes, and excrements of all kinds, from which circumstance it has a most offensive odour.

55 *Aura.* *Carrion vulture*, or *turkey buzzard* (*carrion crow* of Jamaica).—Body gray brown; quill feathers black; bill white; the sides of the head warted; legs flesh-coloured. —Common in the W. Indies, and in N. and S. America. Somewhat larger than the black eagle. Is protected in America for its use in devouring dead carcases and serpents, which it does, along with dogs, in the greatest harmony. It will seize meat from the shambles, breathes a most fetid odour, and, when taken, vomits up an intolerably stinking matter. Roosts by night, in flocks, on the highest branches of trees. They are generally very tame in their wild state, probably owing to their being more caressed than molested by man.

56 *Leucocephalus.* *White, ash-coloured*, or *Angola vulture*.—Body snowy; quill and tail feathers black; collar white; head and lower part of the neck covered with white down; middle toe covered with 11 distinct scales; claws black. About the size of a female turkey. The female exceeds the male in size, and differs chiefly in being less tinged with reddish. The young have the whole of the naked parts about the head covered with a grayish down.—This species is usually seen in pairs, and not in large flocks, like many of the genus; or, if 10 or 12 alight on one carcase, they are accidentally allured by the smell, which acts on their delicate organs at inconceivable distances. They feed on all manner of carrion, and on lizards, snakes, frogs, and even excrements. They build among the rocks, and lay four eggs. In some parts of Africa they are very common, and in others more rare. The natives tame and respect them, as they contribute to rid their grounds of nuisances. They likewise occur in Norway and Sardinia. Mr Latham supposes that this species is the *vautour de Norvège* of Buffon; the *sacre d'Egypte* of the same author, perhaps the *Angola vulture* of Pennant, and the *rachamah* of Bruce. "When, however (adds this celebrated ornithologist), the division of the *vulture* genus into real species may take place, is not for us to determine; the variety among individuals, from different periods of life, as well as the different appearances of those in a state of confinement, to what the plumage has, when at large, cannot fail to create no small difficulty; added to that, very few travellers are naturalists in a sufficient degree to discriminate one part of nature from another; besides, the subjects in question being mostly extra European, we cannot wonder at being so long in the dark."

57 *Percnopterus.* Plate CCCXCIII. fig. 1. *Aquiline* or *Alpine vulture*.—The male of this species is almost wholly white; quill feathers black, with hoary edges, except the two outermost, which are wholly black. The female is all over brown, with the four outer quills black. In both the bill is black; cere yellow; nostrils constantly dripping moisture; feet naked. Inhabits Egypt, Palestine, Syria, and Persia. They fly in large troops, and are extremely useful in destroying mice, with which some countries, of which they are natives, are infested, such as Palestine. The same species, it is said, inhabits the Swiss Alps, where they are of an immense size. Some have been measured exceeding twelve feet from tip to tip of the wings.

58 Falco.

Gen. 2. Falco, *Falcon*.

Bill hooked, and furnished with a cere at the base; head covered with close-set feathers; tongue bifid.

59 Character. Though the birds of this genus are all carnivorous, they seldom feed on carrion, except when pressed by hunger, which they can endure for a long time. They have a very acute sight, and pounce down on their prey with astonishing swiftness and force. From their great strength, they are capable of carrying birds nearly as heavy as themselves, to a great distance, for provision to their young. Their middle toe is slightly connected with the outermost.

A. *Bill hooked only at the point, bearded at the base with extended bristles.*

60 *Serpentarius.* *Snake-eater*, or *secretary vulture*.—Body black; hind-head crested; tail feathers white at the tips, the two middle ones longest; legs very long. Bill black, cere white; orbits orange, and naked; irides pale cinereous; tail rounded; legs brownish; claws short, black, hooked, not very sharp; crest capable of being erected or depressed.—In seizing its prey, this bird makes use of its wings, with which it inflicts violent blows by means of a bony protuberance at the bend of the wing. It is also by its wings that it defends itself against the bites of venomous snakes, until the latter, tired with their efforts, or nearly bruised to death, are easily dispatched. This species likewise preys on turtles, lizards, and even grasshopers and other insects. When in a domesticated state scarcely any kind of food comes amiss to it; and, if young birds are presented to it, it will take them by the bill foremost, and swallow them whole. One of those which Le Vaillant killed, had 21 young turtles, 11 small lizards, and three snakes, in his stomach. Like other birds of prey, it is observed to bring up the undigested parts of its food, in the form of round pellets. In pairing time, two males will often be found engaged in a violent contest for a female. The secretary vulture is

Accipitres. is three feet high, remarkable for the length of its legs, and inhabits interior Africa and the Philippine islands. These birds make a flat nest, like that of the eagle, full three feet in diameter, lined with wool and feathers, in some high tuft of trees, and usually concealed from observation.

61 Harpeyia. *Crested* or *Oroonoko eagle*.—Head crested with long feathers; body beneath variegated; eyes with a nictitant membrane. Under the crop, white feathers, which, when the bird is irritated, fall to the ground. Erects the crest in the form of a coronet; is said to be able to cleave a man's skull at a stroke. Inhabits Mexico, Brazil, and other parts of South America, and is as large as a sheep.

62 Albicilla. *Cinereous* or *white-tailed eagle: erne* of the Scots.—Cere and feet yellow; tail feathers white, the middle ones tipt with black; head and neck pale cinereous; irides and bill pale yellow; nostrils, and the space between the eyes, bluish, with a few bristles; body and wings cinereous, mixed with brown; tail white; legs, below the knees, downy, glossy yellow; claws black. —Size of a turkey, feeds on birds and fish. Inhabits Europe, and frequently occurs in Scotland and the Orkney islands.

B. *Feet generally feathered, of a large size.*

63 Melanaetos. Plate CCCXCIII fig. 2. *Black eagle*.—Cere yellow; feet yellow, and somewhat downy; body rusty black, with yellow streaks; bill horn colour, verging on blue; irides chesnut; exterior part of the tail white, with blackish spots, tipt whitish; legs dirty white; toes yellow, claws black. Two feet ten inches long. Inhabits Europe and America.

64 Ossifragus. *Osprey* or *sea eagle*.—Cere and legs yellow; feet half covered with down; body of a rusty colour; inner vanes of the tail feathers white.—It is distinguished by the colour and figure of its nails, which are of a shining black, and form an entire semicircle; by its legs, which are naked below, and covered with small yellow scales; and by the beard of feathers which hangs from the chin, and which has occasioned its receiving the name of the *bearded eagle*. It measures from the end of the bill to the point of the nails, three feet and a half, and its wings expand to betwixt six and seven feet. It loves to haunt the sea shore, and often frequents inland tracts, near lakes, marshes, or rivers that are stocked with fish; but, though it preys on the finny tribe, it also attacks game, and, being large and strong, seizes and carries off geese and hares, and sometimes even lambs and kids. It catches fish even during the night, when the noise of its plunging into the water is heard at a great distance. In attempting to lay hold of overgrown fish, it is sometimes dragged under water, being unable to disengage its talons. It inhabits Europe and North America, and was found by Captain Cook, in Botany island. It is not uncommon in Scotland and Ireland. "From the astonishing height (says Mr Montagu), these and some other birds fly, we are led to believe they are capable of living in a much lighter air than other animals. From the top of some of the highest mountains in Scotland we have seen several soaring together at so great a distance as to appear scarcely larger than a swallow."[1] The female sea eagle seldom lays more than two eggs, and sometimes produces only a single young one.

65 Chrysaetos. *Golden eagle*.—Cere yellow; feet downy, and rusty-coloured; body dark brown, irregularly barred; tail black, and covered with ash-coloured bars. It greatly resembles the preceding, but is distinguished from it chiefly by its legs, which are yellow, short, strong, and covered with feathers to the feet. The general length of this species is about three feet and a half; the breadth eight feet; and it usually weighs about twelve pounds. It breeds in the most inaccessible rocks, and lays three or four white eggs. It inhabits Europe and Siberia, and is said to be not unfrequent in the mountainous parts of Scotland, Ireland and Wales, though it has been frequently confounded with the sea eagle. It feeds on lambs, kids, and all kinds of game, and has been known to carry off infants to its nest. It is remarkable for its longevity and abstinence from food; some having been kept in menageries for upwards of a century; and Pennant records an instance of one which lived twenty-one days without any sustenance whatever. It flies high, during serene weather, and descends nearer the earth in storms.

Ring-tailed, white-tailed, black, or *common eagle*.—Cere yellow; feet downy, and of a rusty brown colour; back brown; tail with a white transverse band. In the bill, cere, irides, and legs, it resembles the preceding, to which it is also nearly equal in size; but the plumage is rather darker, and the tail is white for two-thirds of its length. It inhabits Europe, Asia, and America; and is trained by the Tartars to hunt hares, antelopes, and foxes. In Scotland, it is very destructive to deer, which it will seize between the horns; and, by incessantly beating it with its wings, soon makes a prey of the harassed animal. It likewise makes great havock among the white hares and ptarmigans. It builds in high precipices and cliffs; and the nest of a pair has been observed in the same spot, in the Orkney islands, beyond the memory of man. Willoughby describes a nest of this species found in the Peak of Derbyshire, as composed of large sticks, lined with two layers of rushes, between which was one of heath. It contained one young, and an addle egg, and by them a lamb, a hare, and three heath pouts.—There is a variety, with a white tail, tipt with brown. 66 Fulvus.

White eagle.—Entirely white. Inhabits the Alps; of the size of the golden eagle. 67 Albus.

Fierce eagle.—Cere green; body brown above; back, belly, and tail coverts snowy, variegated with chesnut spots; tail feathers equal, brown, with four paler bands; bill leaden black; eyelids blue; irides yellow; head and neck ferruginous, mixed with whitish; quill feathers twenty-six, black above, white beneath, tipt with gray; tail feathers twelve, white beneath; claws sharp; upwards of two feet long; very rapacious; inhabits Russia; was found frequent near Astracan in the winter of 1769; will not touch dead animals. 68 Ferox.

Kite.—Cere yellow; tail forked; body brown; head whitish or grey; back and wing coverts dusky, edged with ferruginous, the under parts more or less ferruginous, streaked with dusky, and lightest in the breast; quill feathers dusky black, with bars more or less obscure; tail bright ferruginous; legs yellow; claws black. But there are several varieties. The female is somewhat larger than the male, measuring in length two feet four inches, and five feet six inches of outstretched wing. It is readily distinguished from its congeners by the remarkable forking of its tail, and by its smooth and even flight, which resembles a sailing or gliding through the air, 69 Milvus.

Accipitres. air, without any apparent motion of its wings. It frequently, however, soars very high, and, though beyond the reach of human vision, will distinctly perceive its prey, and dart down on it with irresistible force. Its attacks are confined to such animals as are found on the ground, such as young rabbits, hares, game of all kinds, poultry, and young birds incapable of flying. It will also destroy young lambs, and feed greedily on carrion; but in default of these, will readily devour mice, rats, worms, and even snakes.—The kite occurs as far north as Greenland, and as far south as Guinea and Senegal. It is common in England, where it continues the whole year; but from the more northerly latitudes, it retires to Egypt before winter, and is said to breed there, and returns in April to Europe, where it breeds a second time, contrary to the nature of rapacious birds in general. The nest is composed of sticks, and lined with wool, the inner bark of a tree, hair, and other soft materials, and is usually made in the fork of some large tree. The eggs are generally three, rarely four, somewhat larger than those of a hen, of a dirty white, with a few rusty spots at the larger end.

70 *Haliætos.* *Bald buzzard, osprey, fishing hawk*, &c.—Cere and feet blue; body brownish above, white below; head whitish; a brown bar descends from each eye by the sides of the neck to the wings; legs naked, short, strong; claws remarkably long, hooked, and black. Inhabits Europe, Siberia, and America, frequenting marshy places, and the neighbourhood of large rivers and lakes, pouncing on fish with great rapidity and dexterity, and carrying them off in its talons to a small distance to feed on them. It builds its nest on the ground among reeds, and lays three or four eggs of an elliptical form, rather less than those of a hen. Mr Montagu found the nest of this bird on the top of a chimney of a ruin in one of the islands of Loch Lomond. The usual length of the bald buzzard is two feet, and its extent of wing five. The species is now rarely met with in England, but may be frequently seen near the lake of Killarney in Ireland. There are several varieties, among which may be included those of Carolina and Cayenne. Some of the ancient writers, and even Linnæus, have very erroneously alleged, that the left foot of the bald buzzard is subpalmated.

C. *Legs naked, of a smaller size.*

71 *Buteo.* *Buzzard*, or *Puttock*.—Cere and feet yellow; body brown; belly pale, with brown spots. Scarcely any two individuals of this well-known species are precisely alike. The ordinary length of the body is twenty inches, and the extent of wing four feet and a half. The buzzard is one of our most common species of falcon. It is remarkable for its sluggish, inactive disposition, seldom remaining long on wing, except in the breeding season, when it ascends spirally to a great height. It makes its nest in the fork of a tree, of large sticks, and lines it with wool, hair and other substances, and sometimes takes possession of a deserted crow's nest, which it accommodates to its purposes. The eggs are two or three, rather larger than a hen's, of a dirty white, and, for the most part, with rust-coloured spots at the larger end. It feeds and tends its young with great assiduity; and Ray affirms, that, if the female be killed, the male takes charge of them, and patiently rears them till they are able to provide for themselves. This bird will continue for many hours perched on a tree or eminence, whence it darts on such birds, small quadrupeds, reptiles, or insects, as come within its reach.

Honey buzzard.—Cere black; feet half naked, and yellow; head ash-coloured; tail with cinereous bands, and tipt with white; of nearly the same size as the preceding, and, like it, subject to considerable varieties in its markings. Its nest in respect of form and materials, is similar to that of the buzzard, and it sometimes occupies that of other birds. Its eggs are of an ash-colour, with small brown spots. Mr White of Selborne found only one egg in the nest, smaller, and not so round as that of the buzzard. The name seems to have been given it from its feeding on the larvæ of wasps; but it is also fond of various other insects and of field mice, frogs, and lizards. It occurs in all the northern parts of Europe, and in the open tracts of Russia and Siberia, but is far from common in England. Buffon observes, that it is frequently caught in the winter, when it is fat and delicious eating. 72 *Apivorus.*

Moor buzzard, duck hawk, or *white-headed harpy*.—Cere green; body brownish; crown of the head, throat, axillæ, and feet, yellow. The colouring, however, is subject to considerable variety. Length twenty-one inches; weight twenty ounces. Preys on rabbits, young wild ducks, and other water fowl; and likewise feeds on fish, frogs, reptiles, and even insects; making its haunts in hedges and bushes near pools, marshes, and rivers. The nest is most frequently made on the ground, among short wood, furze, or fern, and sometimes though rarely, in the fork of a tree. It is composed of sticks and rushes, or coarse grass. The moor buzzard is not a bird of rapid flight, but pounces its prey on the ground, and is generally seen skimming over the surface; but, in the breeding season, the male will sometimes soar to a considerable height, and remain suspended on wing for a great length of time. Inhabits Europe. 73 *Æruginosus.*

Goshawk.—Cere black; feet yellow; body brown; tail feathers barred with pale bands, a white line over the eye; bill blue, black at the tip; irides yellow; head brown; body beneath white, waved with black; tail long, cinereous, and white at the tip; claws black. The wing, when closed, does not reach near the end of the tail; of an elegant slender shape, twenty-two inches long. Inhabits Europe, Tartary, and America; is rarely found in England, but is not uncommon in the more woody districts of Scotland, where it breeds, and is a great destroyer of game. It feeds on small birds and mice, and eagerly devours raw flesh. It tears birds to pieces before it eats them, but swallows the pieces entire, and frequently disgorges the hair and feathers, rolled up in small pellets. This species was formerly much prized in the sports of falconry, being used not only for partridge and pheasant, but also larger fowl, as geese and cranes, and sometimes for rabbits. 74 *Palumbarius.*

Gentil falcon.—Cere and feet yellow; body ash-coloured, with brown spots; tail with four blackish bands; somewhat larger than the preceding, though some ornithologists reckon it only a variety. It inhabits the Alps of Europe and North America. "In the days of falconry," observes the author of Elements of Natural History, "this species was in high esteem as a bold and spirited bird. It inhabits the north of Scotland. The king's falconer was anciently obliged to supply the court with hawks; and to this day the office is kept up in 75 *Gentilis.*

in Scotland; a nest of young birds being annually presented by the falconer to the barons of exchequer, who generally give them away in presents."

76 *Peregrinus.* *Peregrine falcon.*—Cere and feet yellow; body ash-coloured above with brownish bands, reddish white beneath, with blackish bands; tail spotted with white. Weighs between two and three pounds, is a bold and powerful bird, and inhabits Europe, and the north of Asia and America. It is not uncommon on most of our rocky coasts, usually frequenting such high cliffs as the guillemot and razorbill resort to for breeding. One that eloped from its master in the county of Forfar, on the 24th September 1772, with four heavy bells on its feet, was killed on the morning of the 26th of the same month, at Mostyn in Flintshire.

77 *Versicolor.* *Spotted falcon.*—Cere yellow; head and body above, white, with pale reddish spots, white beneath; breast a little spotted with ferruginous. Size of the buzzard. Inhabits England; but its history is little known.

78 *Griseus.* *Gray falcon.*—Cere and legs yellow; body dusky gray above, white with oblong black spots beneath; tail feathers long, the two middle ones uniform, the rest spotted. Bill blueish; irides red; head dusky brown before, white behind; sides and chin buff; quill-feathers spotted with white. Inhabits England; but is very rare, and by some esteemed only a variety.

79 *Candicans.* *Jer-falcon, gyr-falcon, Iceland falcon, white jer falcon*, &c.—Cere and feet of a greenish ash-colour; body white, spotted with brown. Bill blueish-ash, black at the tip; claws lead colour. Larger than the goshawk, and subject to variety, from age, sex, and climate, some in the northern latitudes being found quite white, others brown above, white beneath, spotted with brown, and the tail gray, with transverse brown lines. Inhabits Iceland and the north of Scotland, is a very bold bird, and in the days of falconry, was used for the larger species of game, as cranes and herons.

80 *Cachinnans.* *Laughing falcon.*—Cere and legs yellow; eyebrows white; body varied with brown and whitish; crown white, with a black ring. Back, wings, and rump brown; neck, chin, breast, belly, and under parts of the wings white; tail with yellow and black bands. Inhabits South America, and is said to *laugh*, when looked at.

81 *Lanarius.* *Lanner.*—Cere dull yellow; bill and feet blue; body marked with black longitudinal spots underneath. A white stripe over each eye; breast yellowish white, with brown spots; legs short; primary quill-feathers and tail dusky, with rusty oval spots: but there are two or three varieties. Rather less than the buzzard, has its name from tearing its prey into small pieces with its bill. The lanner is very bold, and was formerly used in falconry. It is found in many parts of Europe; inhabits Iceland and the Ferroe isles, Denmark, Sweden, and the Tartarian deserts. It is rare in England, but is said to breed in Ireland, and among the low trees and shrubs in the deserts about Astracan.

82 *Cyaneus.* *Hen-harrier.*—Cere white; legs tawny; body hoary blue; edges of the eye-lids yellow, with an arched line surrounding the throat; bill black; irides yellow; hind part of the head white, with pale brown spots; breast and belly white, the former streaked with dusky; two middle tail-feathers gray on both sides, the rest gray above, white beneath, and all streaked with dusky. These characters, however, are far from constant. This species, in its most perfect state, weighs about thirteen ounces, and is eighteen inches and a half in length. It feeds on birds, lizards, and other reptiles, and is particularly destructive to poultry. It flies low, skimming along the surface in quest of prey. The female nestles on the ground, and lays four eggs of a reddish colour, with a few white spots. Inhabits Europe and Africa. Wallis, in his Natural History of Northumberland, remarks, that it breeds annually on the Cheviot hills, and on the shady precipices under the Roman wall, near Craglake. Dr Latham and other eminent ornithologists have supposed that this and the following are male and female; but the repeated instances of hen-harriers of both sexes having been seen, leave it beyond all doubt that they constitute two distinct species.

83 *Pygargus.* *Ring-tail, ring-tail hawk, white-rumped bay falcon*, &c.—Cere and legs yellow; body cinereous; belly pale, with oblong rufous spots; orbits of the eyes white. Bill pale; irides yellow; tail longish, banded with dusky, and dotted with white, the male marked with transverse, and the female with longitudinal, spots beneath. Length 18 or 20 inches. Inhabits Europe, and the temperate parts of Siberia. Flies higher than the preceding, and sometimes perches on trees. Its eggs are white, much freckled with red.

84 *Tinnunculus.* *Kestril, kestral, stonegall*, &c.—Cere and legs yellow; back purplish-red, with black spots; breast with brown streaks; tail rounded. Crown of the head of a fine cinereous gray; greater quill-feathers black, very slightly tipped with whitish. Bill lead colour, irides dusky and large. The male weighs about seven ounces, and measures 13 inches in length. The female is considerably larger, and distinguished from the other sex by the head and tail being of the same colour as the back, which is not so bright a red brown as the male. Feeds principally on mice, in search of which it is frequently seen hovering in the air and stationary for a great length of time. Preys also on small birds and insects, and was formerly used for catching game. Inhabits Europe, Siberia, and the more temperate parts of North America. One of our most common birds of prey, especially among the rocks and cliffs of the coast, which favour its breeding. The nest is of sticks, and lined with wool and other soft materials; but it sometimes builds on trees, or is contented with the deserted nest of a magpie or crow. The eggs are usually four or five, of a dirty white, blotched with rust colour, of various shades.—It is a handsome bird, whose sight is acute, and whose flight is easy and graceful. It includes two or three varieties.

85 *Piscator.* *Fishing falcon.*—Legs brown; head ferruginous, with long feathers; body cinereous above, pale yellowish white beneath; tail pale brown above, blueish-ash beneath. Bill and irides yellow; margin of the upper feathers rusty brown, the under spotted in the middle with brown. Inhabits Senegal, where it is called *tanas*, preying chiefly on fish, which it takes out of the water, and retires to a convenient place to eat them piecemeal.

86 *Nisus.* *Sparrow hawk.*—Cere green; feet yellow; belly white, waved with grey; tail with black bands. The weight of the male of this species is about five ounces, that of the female nine: the former measures in length about 12 inches, the latter 15. The male is inclined to rust colour on the breast, the female to whitish. On the back of the head, in both sexes, is an obscure broken patch of white. The quill feathers are dusky, barred

Accipitres. red with black on the outer webs, and spotted with white at the base of the inner. The legs are long, slender, and yellow. In some the back is spotted with white, and others have the body entirely of that colour. The sparrow-hawk is very common in our wooded and inclosed districts, but is less frequent in the more champaign parts. The female sometimes builds her nest in hollow trees, high rocks, or lofty ruins, but more frequently takes possession of that which has been deserted by a crow, laying four or five eggs, of a dirty white or blueish tinge, blotched at one of the ends with rust colour. It is very widely diffused over the world, from Russia to the Cape of Good Hope. It is bold and spirited, making great destruction among pigeons, young poultry, and small birds of all kinds, which it will attack and carry off in the most daring manner; at the same time, that it is obedient and docile, and can be easily trained to hunt partridges, quails, larks, &c.

87 Subbuteo. *Hobby.*—Cere and feet yellow; back brown; neck white; belly pale, with oblong brown spots. Bill blue; orbits yellow; irides generally chesnut; lateral tail-feathers with blackish bars; primary quill-feathers with oval reddish spots; claws black. The male weighs about seven ounces, and the female nine, or more. Inhabits Europe and Siberia, breeds in Britain, but leaves us the latter end of October. It build in trees, and sometimes takes possession of a deserted crow's nest, laying three or four eggs, which are said to be white. Though small, it is inferior to none of the falcon tribe in courage, and will frequently pounce a partridge; but its favourite prey is the lark, which it terrifies to such a degree, that it sometimes flies to man for protection, and will allow a net to be thrown over it.

88 Æsalon. *Merlin.*—Cere and feet yellow: head rusty; body above, of a blueish ash, with spots and rusty streaks; beneath, yellowish-white, with oblong spots. Bill blueish; irides dusky; tail alternately streaked with dusky and reddish; claws black; eggs brown red. There are several varieties. The merlin is a small species of falcon, being scarcely larger than the blackbird, but is very rapid on wing, and was esteemed for its courage in hawking. It flies low, and is generally seen skimming along the side of a hedge, or over the surface of the ground, in pursuit of small birds. Inhabits Europe; visits the south of England in October, about the time the hobby retires, but has never been observed to breed farther south than Cumberland, where it has been found more than once, with four young ones, placed on the ground.

89 Minutus. *Minute falcon.*—Cere brown; legs yellow; body white beneath; tail-feathers brown, branded with black, About 11 inches long. Inhabits Malta; and occurs, though rarely, in England.

90 Pumilus. *Tiny falcon.*—Legs yellow; body brown-ash; beneath whitish, with blackish bars; crown whitish. Hardly six inches long. Inhabits Cayenne.

Gen. 3. STRIX, *Owl.*

91 STRIX.

92 Characters. Bill hooked; no cere; nostrils oblong, covered with bristly recumbent feathers; head, eyes, and ears large; tongue bifid.

These are nocturnal birds, with the organs of vision so constructed as to see in the dark. Their sense of hearing is very acute, by means of a particular membrane at the opening of the external ear. They can move the outermost toe either backwards or forwards. Accipitres. They feed on carrion, living small birds, hares, mice, field-mice, lizards, &c. When they venture abroad in day light, they are chaced, and insulted by smaller birds, especially by the crow. In their manner of life, round head, &c. they have some affinity to cats. During the winter, they live retired, fasting, or sleeping in towers and old walls.

A. *Eared.*

Great owl, great eared owl, great horned owl, &c.— 93 Bubo. Body of a reddish or tawney colour; irides yellow; head and body variegated with black, brown, ash, and rusty spots and lines; claws large, much hooked, and dusky. Liable to considerable varieties. Nearly the size of an eagle, and very strong, preying on hares, rabbits, moles, rats, mice, and sometimes bats and reptiles. It inhabits Europe, Calmuc Tartary, and South America, haunting mountainous rocks and caverns. Its nest is nearly three feet in diameter, and composed of sticks bound together by fibrous roots, and lined with leaves. It generally lays two eggs, somewhat larger than those of a hen, and variegated, like the bird itself. The young are very voracious, and are plentifully supplied with food by the parents. This bird is by no means common in Great Britain, though it has been occasionally shot both in England and Scotland. It endures day light better than most of the genus, flies low in the day, but sometimes soars very high during the night. 94

Virginian eagle owl.—Size of the common eagle owl; Virginiana. ear feathers large, rise above the base of the bill which Plate CCCXCIII. is black; irides golden yellow; upper part of the body fig. 4. brown, variegated with slender rufous and cinereous lines; under part pale-ash, transversely stripped with brown; throat white; lower part of the neck and sides of the breast orange brown, spotted with darker brown; quills and tail banded with brown; legs and half the toes covered with cinereous feathers; claws horn colour. Inhabits America, Kamtschaka, and Astracan. Is a little smaller than the great horned owl, and is supposed by some to be only a variety. 95

Ceylonese eagle owl.—Bill horn colour; irides yellow; Zeylonensis. upper part of the body pale reddish brown, under part Plate yellowish white; ears short, pointed; first quills and tail CCCXCIII. barred with black, white, and pale red; legs naked to fig. 3. the knees. Length 23 inches; weight two pounds and near 10 ounces. Native of Ceylon. 96

Long-eared or *horn owl.*—Ears with six feathers. Ears Otus. black and yellow; irides yellow; back and wing coverts dusky brown, gray, and yellowish-rusty; breast and belly pale yellow, with brown longitudinal lines; tail barred with ash-colour, and dusky; legs and feet feathered to the claws. About 14 inches long; but there is a variety that is much smaller, and another which is distinguished by the greater darkness of the body. Diffused over the four quarters of the globe, frequenting forests and wooded tracts, and manifesting a partiality to fir, box, or holly plantations, where it more readily conceals itself by day among the ever-green foliage. Its principal food is mice, and sometimes small birds taken at roost. It remains with us the whole year, and is frequently taken; yet little is known of its habits. 97

Short-eared owl, hawk owl, mouse hawk, &c.— Brachyotus. Ears short; body above brown, feathers-edged with yellow; beneath pale yellow, with longitudinal dusky streaks.

Accipitres. streaks; head small and hawk-like; bill dusky; irides yellow. Length 14 inches, stretch of wing three feet. Inhabits Europe, Siberia, and America, chiefly in mountainous or wooded countries, and feeds principally on field-mice. Visits England in the latter part of the year, and disappears in spring. It flies by day, and is sometimes observed in companies. It is supposed to breed in the Orkneys, and probably in Norway, making its nest of dry grass, on the ground, and laying three or four white eggs.

98 Scops. *Little horned owl*.—Ears of one feather each. Gray, rufous, brown or blackish, according to age; legs spotted with brown; toes and claws brown. Between seven and eight inches long. Inhabits Europe, and preys on field mice.

B. *Earless.*

99 Nyctea. *Snowy* or *great white owl*.—Body whitish, with a few brown lunated spots. Bill black, and almost hid in the feathers; irides yellow; legs covered with white feathers to the toes; claws black. This species is sometimes quite white, and sometimes varies with very numerous spots. About two feet long; flies abroad by day; preys on herons, hares, mice, and sometimes carrion, but is particularly fond of ptarmigans. Makes a howling noise. Inhabits the northern parts of Europe and America, particularly Sweden, Iceland, and Hudson's Bay, and sometimes, though rarely, Pennsylvania.

100 Nebulosa. *Gray* or *barred owl*.—Head, neck, breast, back, and wing coverts brown, spotted with white; belly and vent dirty white, streaked with brown; tail with brown and whitish bands, tipt with whitish. Weighs about three pounds, is two feet long, and four in extent of wing. Feeds on hares, mice, and cranes. Inhabits Hudson's Bay and New York, and rarely occurs in England.

101 Flammea. *White* or *common owl*.—Body pale yellow, with white spots, beneath whitish, with black spots. Bill white; irides dusky; tail feathers white within, with dusky lines on the outside; 14 inches long, and weighs about 11 ounces. This species is so well known, that we need not more minutely describe it. It inhabits Europe, America, and Northern Asia, and is by far the most common of British owls, being distinguished by various provincial appellations, as barn owl, gillihowlet, howlet, madge-howlet, church owl, hissing owl, screech owl, &c. It is partial to the habitations of man, and is rarely found in woods. Its ordinary haunts are barns, churches, old houses, and other uninhabited buildings, in which it continues during the day, but which it leaves in the evening, in quest of prey. Its flight is accompanied with loud and frightful cries, and its repose with a blowing noise, like the snoring of a man; when alarmed, it snaps its bill with great force. It makes scarcely any nest, but deposits five or six whitish eggs in the holes of walls. It feeds on mice, and small birds, which it swallows whole, and afterwards discharges the bones, feathers, and other indigestible parts at its mouth, in the form of small round cakes, which are called *castings*, and some bushels of which are sometimes found in the hollows of decayed trees, near farm-houses or villages, in barns, out-houses, &c. When a pair have young ones, they sally out alternately in quest of food for them, and generally return every five minutes, with a live mouse. Dr Latham mentions, that he received a specimen from Jamaica, which differed in no respect from our common owl.—The white owl is very susceptible of domestication, when taken young. Accipitres.

Tawney or *brown owl*, *common brown* or *ivy owl*, *black owl*, *howlet*, *wood owl*, &c.—Body ash-coloured, the third flag-feather the longest; plumage marked above with dusky spots and points; breast and belly yellowish, mixed with white; beneath with dusky streaks; irides dusky; tail with pale brown and black spots and lines. Fourteen inches long; stretch of wing two feet eight inches; weight of the female 19 ounces. Inhabits Europe and Tartary. This is another very common species. It resides chiefly in woods and plantations of fir; concealing itself in the thickest recesses; sometimes it settles on the ground, but if molested, takes shelter in a neighbouring tree. It is rarely seen on wing by day, except forced from its haunts, the light dazzling it to such a degree that boys hunt it down with sticks and stones. It breeds in the hollows of trees, and sometimes in barns, where it is protected by the farmer, as it is an excellent mouser. It lays two or three eggs of a roundish form, and dull white colour. It is the only species known to hoot, besides which, it makes a disagreeable screaming noise. It is a great enemy to young pigeons, leverets, young rats, &c. but chiefly subsists on mice.—"We have taken this bird," says Mr Montagu, "in its mature state, as well as young, and found no difficulty in either case of preserving them alive. They were never observed to drink; and indeed for many months together had no water offered them."—The *ulula* of Linnæus is now esteemed only a smaller variety of the *stridula*. 102 Stridula.

Little owl.—With white spots arranged in five rows on the flag-feathers; bill whitish brown; irides pale yellow; head, back, and wing coverts pale brown, with white spots; breast whitish, variegated with rusty. Scarcely larger than a blackbird, but varies considerably both in respect of size and markings. Inhabits Europe, North America, and the West Indies. Is very rare in England, though it has sometimes been found in Yorkshire, Flintshire, and the neighbourhood of London. It is said to frequent ruined edifices in France, and to build in chimneys, in Carniola: but it frequently nestles in the holes of rocks and walls, and lays five or six eggs, spotted with yellowish and white. It can fly by day, and give chase to swallows and other small birds on wing, but mice are its principal food. 103 Passerina.

White-fronted owl.—Body rusty brown, paler beneath; forehead white; quill feathers barred with black and white. Only five inches long. Native of North America. 104 Albifrons.

Gen. 4. Lanius, *Shrike*. 105 Lanius.

Bill nearly straight, with a dent on each mandible, near the end, naked at the base; tongue jagged at the point. 106 Characters.

The birds of this genus form a connecting link between the falcons and pies, and have been differently classed by different ornithologists. Though comparatively small, they are very courageous, will attack birds much larger than themselves, and are called *butcher birds*, because they frequently kill several, before they begin to feed. They fix on their victims with their talons, split the skull with their bill, and then feed on them at leisure.

Accipitres.

107 Collaris. *Collared shrike, canary biter*, or *fiscal*.—Tail wedged; body black, white beneath; first quill feathers white at the base; bill and head blackish; tail feathers, except the four middle ones, white at the tips. Very common at the Cape of Good Hope, also found in Senegal, and in the interior parts of Africa. Twelve inches long. Feeds on beetles, grashoppers, and other insects, which it not only catches with great dexterity; but when it cannot consume them all, will stick them on the pales of farm yards, till it has occasion for them. It also seizes on sparrows and canary birds, of which it devours only the brains.

108 Excubitor. *Cinereous shrike, great cinereous shrike, greater butcher bird, mattagess, night jar*, &c.—Tail somewhat cuneiform, white on the edges; back gray; wings black, with a white spot; bill black, with bristles at the base; upper parts of the plumage of a pale blue ash, the under parts white; legs black. The female differs chiefly in the under parts, which are of a dirty white, marked with numerous semicircular brown lines. There is a variety, with the body white, legs yellowish, and bill and claws blackish; and another with lesser wing coverts and reddish shoulders. Inhabits Europe and North America. Is rather a scarce bird in England, but is said to breed among some of our mountainous situations; coming in May, and departing in September. It makes a nest of heath and moss, lined with wool and gossamer, and lays six eggs, of a dull olive green, spotted with black at the larger end. According to Buffon, it is common in France, where it continues all the year; it kills rats, mice, and small birds, affixing its prey to a sharp thorn, and tearing it in pieces with its bill; it is also said to imitate the notes of some other birds, by way of decoying them to their destruction. Mr Pennant observes, that when kept in a cage, it sticks its food against the wires before it will eat it.

109 Collurio. *Red-backed shrike, lesser butcher-bird*, or *slusher*.—Tail somewhat wedged; back hoary; four innermost tail-feathers of one colour; bill of a leaden hue. Irides hazel; head and lower part of the back of a light gray, upper part of the back and wing-coverts of a bright rusty red; breast, belly, and sides, of a fine pale rose, or bloom colour; a black streak passes from the bill through the eyes; legs black. Length about seven inches; weight eight drams. The female weighs two drams more, and has all the upper parts of a ferruginous brown. The manners of this species are similar to those of the last. It kills small birds by piercing the skull with its bill, and insects by transfixing them on the thorn of the sloe-bush. It tears off the body of the chaffer, and leaves the elytra, wings, and head behind. It imitates the song of many of the sparrow tribe, and thus entices them within its reach. It chiefly haunts inclosed moist situations, makes its nest in some thick hedge, composing it very skilfully of moss and fibrous roots put together with wool and lined with hair, and lays five or six eggs of a bluish-white colour, with a circle of brown near the broad end. It inhabits Europe and Africa, visits Britain in May, and departs to some warmer climate in September. Among its varieties Gmelin includes *lanius rutilus* of Latham, or *woodchat*, which is very rare in this country.

110 Tyrannus. *Tyrant shrike*.—Body cinereous, white beneath; crown of the head black, with a longitudinal tawney streak. Eight inches long. There are several varieties, all natives of America and the West Indies, and all of a fierce and audacious disposition, fixing on the backs of other predaceous birds, and making a continual chattering noise, till they force them to retire.

Picæ.

ORDER II. PICÆ. 111 Picæ.

111 Characters. THE distinguishing marks of this order are, a bill somewhat compressed, more or less crooked, and always convex; toes divided, and adapted either for climbing (*scansorial*) or, for stepping, (*gressorial*). Some feed on insects, worms, and the flesh and offal of other animals, and some on the seeds and juices of plants. During the breeding season, they are monogamous, and make their nests on trees; and during incubation, the female is often fed by the male. There are a few genera, however, which do not exactly correspond with these characters.

Gen. 5. PSITTACUS, *Parrot*. 113 Psittacus.

114 Characters. Bill hooked; upper mandible moveable, and, for the most part, covered with a case; nostrils rounded, and placed in the base of the bill; tongue fleshy, obtuse, entire; feet scansorial.

This very numerous genus, which contains upwards of 140 species, is peculiar to the warmer regions of both worlds. The birds which belong to it, resemble the accipitres in the form of the bill, but in their manners coincide with the other genera of this order. They feed on the seeds and fruits of various plants; are very docile, and by means of their obtuse tongue, may be taught to imitate human speech. They climb easily, assisting themselves with their bill. They associate in pairs, and attain to a great age. Some species equal the domestic fowl in size, while others are no larger than a sparrow. In Europe, they sometimes lay eggs, but seldom sit on them. In their native climates, the male and female sit on them alternately.

A. *Tail long, and wedge-shaped.*

115 Macao. *Red and blue maccaw*.—Quill-feathers blue above, rufous beneath, scapulars varied with blue and green; cheek naked, wrinkled. Body scarlet; upper mandible white, lower black; temples white; wing-coverts generally yellow; tail long and red; feathers blue at the sides. Two feet seven inches in length, size of a capon. Inhabits Brasil, Guiana, and other regions of South America, affecting moist palm woods, and living on the fruit of the trees. When driven by hunger to feed on the manchineel apple, its flesh is poisonous, though the bird itself receives no injury. Makes its nest in decayed trees, enlarging the hole, if necessary, with its bill, and lining the inside with feathers. The female lays two eggs at a time, about the size of those of a pigeon, and spotted like those of a partridge. Breeds twice a year, the male and female sitting on the nest alternately, and reciprocally nursing and feeding the young birds. The latter are tamed with great ease, and may even be taught to speak, but the old birds are clamorous and unmanageable. Though the flesh is hard, black, and unsavoury, it makes good soup, and furnishes a great part of the food of the inhabitants of Cayenne, as well as other parts of South America. Like other parrots it is subject to fits when kept tame. The strength of its

Picæ. its bill is sufficient to break a peach-stone with great ease.

116 *Aracanga.* *Red and yellow maccaw.*—Pale scarlet; scapulars yellow, tipt with green; quill-feathers blue above, rufous beneath; cheeks naked and wrinkled. Size of the preceding. Inhabits Guiana, Brasil, and Jamaica.

117 *Tabuensis.* *Tabuan parrot.*—Head, neck, breast, and belly, purple; back and wing-coverts green; crown terminated by a lunular blue mark; first quill-feathers and greater part of the tail blue. Length, 19 inches. A beautiful species, found at Tonga Taboo, and the other Friendly isles in the South seas. The green variety, with the head, neck, breast, and belly, scarlet, occurs in New South Wales.

118 *Elegans.* *Beautiful parrot.*—Head, neck, and body, red beneath, brown above; interscapulars pale blue, mixed with red; tail greenish-brown, tipt with white. Varies, with the wings, tail, and body green above. From 12 to 15 inches long. Inhabits the Molucca islands.

119 *Pennantii.* *Pennantian parrot.*—Scarlet; fore part of the back black. waved with scarlet; sides and throat blue; quill-feathers each with a white spot. There is a variety with a pale band in the middle of each wing. The female has the upper parts of the neck and body greenish, top of the head red, and a patch of the same colour under each eye; chin and throat blue; lower part of the neck and breast, as also the rump and vent, red; middle of the belly dusky green; tail dark blue, fringed with chesnut; shoulders blue, and the rest of the wing the same, but darker. Fifteen inches long. Inhabits New South Wales.

120 *Gloriosus.* *Splendid parrot.*—Bright blood-red; back feathers edged with black; chin, wing, and tail blue. Sixteen inches long. Inhabits New Holland.

121 *Ornatus.* *Orange-billed parrot*, or *long parrakeet.*—Of a yellowish green colour; the hind part of the head, the throat, and breast red; crown of the head and ears blue, with ash-coloured orbits. Eight inches long. Inhabits India. Like other small species with long tails, is not easily taught to speak.

122 *Murinus.* *Gray-breasted parrakeet.*—Olive; face, chin, and breast mouse-colour, quill-feathers green. Bill and legs gray; tail five inches long. About the size of a thrush. Tame and gentle, and easily taught to articulate. Common at Monte Video.

123 *Cornutus.* *Horned parrot.*—Green; head scarlet, with two long feathers standing out like horns; collar and rump straw-colour; outer edge of the quill and tail feathers blue. Bill and legs black blue; temples orange; irides golden; wing-coverts at the tips and within dusky; tail black beneath. Length 11 inches, size of a small dove. Inhabits New Caledonia. Figured in Latham's Synopsis.

124 *Formosus* *Ground parrot, New Wales parrot*, or *black-spotted parrakeet of Van Diemen's Land.* Green; four middle tail feathers barred with green and black, the rest with black and yellow; bill and legs black; tail much wedged. This is a most elegant and beautiful species, about 12 inches long, inhabiting New South Wales, and other parts of New Holland, where it is known by the name of *goolingnang*. It is rarely seen, except on the ground, particularly in moist places. It is not known to perch on trees like other parrots, but rises from among the grass, and immediately alights in it again. The legs and toes are more slender than usual in this genus, and the claws more straight. Picæ.

Otaheite parrakeet.—Blue; feathers of the head long; chin and throat white; bill and legs red. Tongue fringed at the end; only five inches long; inhabits Otaheite, and feeds on the fruit of the banana. 125 *Taitianus.*

B. *Tails short, and even at the ends.*

Banksian cockatoo.—Splendid black; crest small; head and wing coverts dotted with buff; outer tail-feathers scarlet in the middle, barred and tipt with black. Nearly three feet long, but varies both in size and markings. Inhabits New Holland, and was brought to England by Sir Joseph Banks. Figured in Latham's first Supplement. 126 *Banksii.*

Great white cockatoo, or *yellow-crested cockatoo.*—White; crest folding, and yellow. Bill, cere, irides, legs and claws black; orbits naked and white; quill and lateral tail feathers, from the base to the middle, sulphureous on the inside; feathers of the neck loosely flowing; crest five inches long, and erectable. Length 18 inches; size of a domestic ordinary fowl. This, and several other species, frequently repeat the word *cockatoo.* Inhabits the Molucca islands. 127 *Cristatus.*

Ash-coloured or *hoary parrot.*—Bluish-gray; temples naked and white; tail scarlet. Bill black; cere white; irides yellowish white; legs cinereous; claws black. Subject to several varieties. About 20 inches long. Loquacious, and easily taught to speak. Inhabits Africa, and is sometimes called *jaco* from the sound which it commonly utters. 128 *Erythacus.*

Ceram or *purple parrot, Ceram lory*, &c.—Red; orbits ash-coloured; cheeks and wings green; hinder parts of the tail-feathers blue. There are three or four varieties. Size of a dove. Inhabits Ceram, and the other Molucca islands. 129 *Garrulus.*

Purple or *blue-cap lory.*—Red; cap violet; wings green; shoulders and cheeks blue; orbits brown. There is a variety with a blue cap, black orbits, and yellow collar. According to some writers, these are male and female. They inhabit the East Indies, and are remarkable for speaking distinctly, and quickly learning their lesson. They are in general scarce, and fetch a high price. 130 *Domicella.*

Violet cap, or *black-capped lory.*—Purple; cap violet; wings green; breast, cheeks, and tail blue; orbits pale flesh-colour. Upwards of 10 inches long; inhabits the Philippine isles, particularly Yolo. It is so familiar and playful, that it is much to be regretted that its duration of life proves so short in these colder regions. 131 *Lory.*

Yellow-winged parrot, or *yellow-headed creature.*—Green; front and orbits whitish; crown, cheeks, chin, throat, and remoter wing-coverts, yellow. Thirteen inches long. Inhabits South America. A friend of the count de Buffon had one of this species alive, which seemed much attached to its master, and yet of a very capricious temper, expecting a return for every demonstration of civility. In its wantonness, it would sometimes bite a little too hard, and laugh heartily, as if pleased with the act; but if chastised for the offence, it became the more refractory, and could be reclaimed only by gentle treatment. It took great delight in tearing every thing to pieces, was dull and silent if confined in 132 *Ochropterus.*

Picæ. in its cage; but when at large, chattered almost incessantly, and repeated every thing that was said to it. It was also, contrary to the disposition of many parrots, very fond of children. During the moulting season, it appeared dejected and uneasy for nearly three successive months. It was for the most part fed on hemp seed, nuts, fruits of all kinds, and bread soaked in wine, but preferred meat, if it could get it. It was observed, that if it fed on this last, it became dull and heavy, and soon lost its feathers. It was also remarked, that it kept its food for some time in its cheeks, whence it was gradually protruded by a sort of rumination.

133 *Passerinus.* *Passerine parrot*, or *blue and green parrakeet.*—Yellowish green, with a blue spot on the wings, which are blue below. Bill, cere, orbits, legs and claws, orange; primary wing-coverts blue. Inhabits Brasil and Guiana, and is the smallest of the genus, being only four inches in length, and of the size of the house sparrow.

134 *Cyanolyseos.* *Blue-collared parrot.*—Yellowish-green, collar blue, rump red. Larger than a pigeon. Inhabits Chili, where it is called *thecau*, and where it often does much injury to the corn, flying in great flocks. When the troop settles, one of them acts as sentinel on a tree, and gives the alarm if any person approaches, from which circumstance it is difficult to shoot them. This species breeds in the holes of rocks, laying two white eggs in the most inaccessible and craggy parts. From the tops of the cliff, the inhabitants let themselves down by ropes to take the eggs and young birds, which are reckoned delicate eating. If robbed of its young, this parrot will lay a second, and even a third, but rarely a fourth time. It is easily tamed, and learns to speak well.

135 *Melanocephalus.* *White-breasted parrot.*—Green, yellow beneath, cap black, breast white, orbits flesh colour. Length nine inches and a half. Inhabits Mexico, Guiana, and the Caraccas in South America. Frequents woods, and seldom approaches inhabited districts. Its call is a shrill whistle, which it often repeats in its flight, nor does it learn to talk. "These birds, says Dr Latham, fly in small numbers together, but are perpetually quarrelling with one another; and, if any one is taken, it refuses all food, till at last it is starved to death. Parrots of the most stubborn nature are often subdued by means of the smoke of tobacco; but this bird is only put into bad humour by the attempt. Whoever, therefore, would have these parrots must train them up young; and this would scarce be worth while, were it not for the sake of variety." Buffon has observed, that it is thicker and shorter-necked than most parrots, that its feathers are more stiffly set on, and that it is of a more dull and sluggish disposition.

136 *Senegalus.* *Senegal parrot.*—Green, yellow beneath, head cinereous, orbits black and naked. Bill cinereous, cere blackish, irides yellow, legs reddish ash. Size of a blackbird; length eight inches and a quarter. Plentiful in Senegal, where it flies in companies of five or six, and perches on the tops of the trees which are scattered in the sandy plains. Its cry is sharp and dissonant.

137 *Pullarius* *Ethiopian parrot*, or *red-headed Guinea parrakeet.*—Green; front red; tail tawney, with a black band, orbits cinereous. Size of a lark; length five inches and a half. Very common in Guinea, and also occurs in Ethiopia, the East Indies, and the island of Java.

Sapphire parrot, or *sapphire-crowned parrakeet.*—Green; rump and breast scarlet, crown (of the male) blue. It sometimes occurs with the head yellowish blue, 138 *Galgulus.* a transverse orange bar behind, and the front and under part of the throat and tail-coverts red. Five inches long. Inhabits the Philippine islands. Sleeps suspended by one foot, and is very fond of the fresh juice of the cocoa-nut tree. "If this is put in a cage (says Osbeck), it whistles very seldom, and commonly grows quite sullen; it hangs itself with its feet so, that the back is turned towards the earth, and seldom changes this situation: it is fed with boiled rice; in which manner in the year 1752, one was brought to Gottenburg.——We observed that their nests were remarkable for their exceeding fine texture; but we did not see the birds. If they had a different construction, the monkeys would be very mischievous to them; but now, before they can get to the opening, the lowest part, as the weakest, breaks in pieces, and the visitor falls to the ground, without any danger to the birds."

Gen. 6. Ramphastos, *Toucan.* 139 Ramphastos.

Bill large, hollow, convex, and serrated at the margins; 140 Characters. both mandibles incurvated at the tips; nostrils behind the base of the bill long and narrow; tongue feathered at the edges; feet mostly scansorial.

The birds of this genus seem to be limited to the tropical regions of South America, and are very impatient of cold. They feed on fruit, especially that of the palm trees. They are generally met with in small flocks of eight or ten, moving from place to place in quest of food, and advancing northward or southward as the fruits ripen, though they are not properly migratory. They make their nests in the hollows of trees abandoned by the woodpeckers, and not formed by themselves, the structure of their bill not allowing of the efforts necessary to make, or even enlarge a hole in the most tender wood, as it yields to the least pressure of the finger. They lay two eggs, and probably breed more than once in the year, as they are pretty numerous. If brought up young they are easily tamed, and become very familiar.

Green toucan.—Green, belly yellow, rump red. Upper mandible yellow, with red sides and a black line in 141 *Viridis.* the middle, the lower black; the base and space round the nostrils red, the teeth in both white, irides and orbits yellow, legs lead colour, claws black, tail wedged and inclining to ash beneath; head, chin, and throat in the male, black, in the female, bay, terminated by a black, narrow, transverse band. Fourteen inches long. Inhabits Cayenne. Its extraordinary large bill gives it a very singular appearance.

Pavonine toucan.—Green, feathers sprinkled with red 142 *Pavoninus.* spots. Bill variegated with yellow and black, legs and claws black. Seventeen inches long. Inhabits the sea-coasts of New Spain, and is said to feed on fish. This last circumstance, however, may admit of doubt. Most of the species will eat fish, and even flesh, in a state of confinement; but their frequent proximity to the water in their natural state, is probably occasioned by the situation of their favourite fruit.

Brasil toucan, or *Brasilian pie.*—Blackish, abdominal 143 *Piscivorus.* band and vent red, rump white. Twenty-one inches long.

Picæ. long. Inhabits South America. The propriety of its Linnæan designation is somewhat doubtful.

144 *Tucanus.* *Yellow-breasted toucan.*—Blackish; abdominal band, vent, and rump yellow. Nineteen inches long. Inhabits South America.

145 *Albus.* *White toucan.*—Entirely white. No other particulars are known of this species.

146 Momotus.

Gen. 7. Momotus, *Motmot.*

147 Characters. Bill strong, slightly curved, serrated at the edges; nostrils feathered, tongue feathered, tail wedged, feet gressorial.

148 *Brasiliensis.* Plate CCCXCV. fig 4. *Brasilian motmot*, or *Brasilian saw-billed roller.*—Green, front bluish-green, hind part of the head violet, crown black. Variegated with green, tawney, blue and cinereous. Body olive-green above, rusty beneath; head large, bill black, legs black, claws hooked. About a foot and a half in length, and nearly equal to a magpie in size. Inhabits Brasil, Cayenne, Mexico, and other parts of South America. It is a solitary bird, frequenting thick forests; chiefly seen on the ground, or on some low branch of a tree, taking short flights when disturbed, and pronouncing the word *houtou*. It makes a nest of dry grass and stalks on the ground, frequently in some hole deserted by an armadillo or other quadruped, and laying for the most part two eggs. It feeds on insects and raw flesh, the fragments of which it macerates in water. When taken, it strikes violently with its bill. Its voice is extremely harsh, weak, and tremulous.

149 Scythrops.

Gen. 8. Scythrops, *Channel-bill.*

150 Characters. Bill large, convex, cultrated, furrowed or channelled on the sides, with the tip bent; nostrils round, naked, placed at the base of the bill; tongue cartilaginous and bifid at the end; toes placed two before and two behind; tail consisting of ten feathers.

151 *Psittaceus.* *New Holland channel-bill, psittaceous* or *anomalous horn-bill.*—Bill pale brown, tipt with yellowish, convex, keeled; nostrils surrounded with a red wrinkled skin; orbits naked; head, neck, and under parts of the body pale bluish-gray; back, wings, and tail cinereous, the feathers mostly with dusky blackish tips; tail long, wedged, its feathers barred with black near the end, and tipt with white; legs short, scaly, and with the hooked claws black. Size nearly that of a crow, and the total length 27 inches. Inhabits New Holland, though not plentifully, and is seldom seen unless in the morning and evening, sometimes in small groups of eight or ten, but frequently in pairs, appearing about Port Jackson in October, and departing in January, but to what country is not known. Both on the wing, and when perched, they make a strange, loud, screaming noise, not unlike that of the common cock and hen when they perceive a hawk or other bird of prey hovering over them. They are supposed to feed principally on the seeds of the red gum and peppermint trees, which they swallow whole. The tail is sometimes displayed like a fan, which gives the bird a majestic appearance.

5

Picæ.

Gen. 9. Buceros, *Horn-bill.* 152 Buceros.

Bill convex, curved, sharp-edged, large, serrated at the margins, with a horny protuberance on the upper mandible near the base; nostrils behind the base of the bill; tongue short, sharp-pointed; feet gressorial. 153 Characters.

The birds of this genus are all inhabitants of the warmer regions of Asia and Africa, and seem to correspond to the toucans of the New World. According to Latham, the circumstance of their feeding on fish requires confirmation.

Philippine horn-bill.—Front bony, flat, and two-horned at the fore part. Varies with a vermilion bill, black belly, and the back and rump brown ash. Body black above, white beneath; quill feathers with a white spot; tail longish and black; legs greenish. Size of a common fowl; inhabits the Philippine islands, and has a cry like the grunting of a hog. It lives in the woods, and feeds on fruits, such as the Indian fig, pistachio, &c. which it swallows entire; and after digesting the pulp, brings up the stones whole, and still fit for vegetation. The Gentoos rank it among their gods. 154 *Bicornis.*

Abyssinian horn-bill.—Black; bony protuberance semicircular on the fore part; orbits, chin, and part of the throat naked, and irides brown. Greater quill feathers white. Total length, three feet ten inches; extent of wing, six feet. On the neck are several protuberances, as in the turkey cock, of a light blue colour, changing to red on various occasions. Occurs in Abyssinia, generally among the fields of *taff*, feeding on green beetles, which frequent that plant. It has a putrid smell, which has occasioned a supposition of its feeding on carrion. It has been seen with eighteen young ones, and usually runs on the ground; but when raised, flies both strong and far. It builds in large thick trees, and when it can, near churches; has a covered nest, like that of a magpie, but four times as large as an eagle's, placed firm on the trunk, at no great height from the ground, and the entry always on the east side. 155 *Abyssinicus.*

Indian horn-bill.—Protuberance flattened forwards, belly tawney, neck with a white collar. Two feet four inches long, rather bigger than a cock. Inhabits the Moluccas, and feeds chiefly on nutmegs, from which circumstance its flesh is very delicate, and has a fine aromatic flavour. In its native places, it is frequently tamed for the purposes of destroying rats and mice. 156 *Hydrocorax.*

Rhinoceros horn-bill, rhinoceros-bird, or *horned Indian raven.*—The horny process on the upper mandible recurved. Inhabits India. Three feet long, and nearly as big as a turkey. Feeds on flesh and carrion, and follows the hunters for the purpose of feeding on the entrails of the beasts which they kill. It is also said to feed on rats and mice, and after pressing them flat with its bill, to toss them up in the air, and swallow them whole, immediately on their descent. 157 *Rhinoceros.*

Panayan horn-bill.—Greenish black; under part of the body dusky red; the prominence of the upper mandible acute above and plane at the sides; bill very long, arched, dusky, having the sides marked transversely with orange-coloured furrows. Size of the raven. Native of the isle of Panay. 158 *Panayensis.* Plate CCCXCV. fig. 2.

Gen.

Picæ.

Gen. 10. Buphaga, *Beef-eater*.

159 Buphaga. 160 Characters. Bill straight, squarish; mandible gibbous, entire, more gibbous at the margins: feet gressorial.

161 Africana. *African beef-eater.*—Upper parts of the body gray-brown, under parts and rump yellowish; bill hardly an inch long, sometimes yellowish, tipt with red, sometimes black; tail wedged; legs and claws black. Eight inches and a half long. Inhabits Senegal, and other districts of Africa. Resembles the starling in its manners, appearing in small troops of a dozen or more. Alights on the backs of oxen, antelopes, and other quadrupeds, and by pressing the elevated part of the animal's hide, which contains the larva of the œstrus, forces it out, and regales on it. It is also said to feed on various kinds of insects. It has a sharp kind of cry, in no respect approaching to a song.

162 Crotophaga.

Gen. 11. Crotophaga, *Ani*.

163 Characters. Bill compressed, semi-oval, arched, carinated on the back; upper mandible angular at each edge; nostrils pervious, or going from one side of the bill to the other.

164 Ani. *Lesser ani.*—Blackish-violet; feet scansorial. Body black; tail long, and wedged; upper mandible incurved at the tip; nostrils oval; tongue fleshy, and entire; legs black. Length thirteen inches and a half; size of a blackbird; and sometimes known by the names of the *razor-billed blackbird*, or *great blackbird*. Inhabits South America and several of the West India islands. This species is gregarious to such a degree, that many females lay their eggs in the same nest, to make which they all unite in concert, and after depositing their eggs, sit on them close to each other, in order to hatch them, each striving to do the most for the general good. When the young are hatched, the parents exert themselves to feed the whole flock. It is still more remarkable, that as soon as the female has laid her eggs, she covers them with leaves, and repeats this operation as often as she is obliged to leave the nest for food. It generally breeds twice a-year; and the eggs are about the size of those of a pigeon, of a sea-green colour, and spotted at the ends. The lesser ani feeds on worms, insects, fruits, and grain, according to the season. The other species resemble this in appearance and manners, but vary somewhat in size and colouring.

165 Musophaga.

Gen. 12. Musophaga, *Plantain-eater*.

166 Characters. Bill strong, triangular, the upper mandible at the base elevated above the crown, both mandibles dentated on edges; nostrils in the middle of the bill; tongue entire and stout; toes placed three before and one behind.

167 Violacea. *Violet plantain-eater.*—Bill one inch and a half; the upper mandible nearly triangular, losing its attachment at the back part, and hanging over the crown; colour of the bill yellow, and reddish towards the end; irides brown; top of the head purple; neck, breast, body and wings violet; legs dusky-black, and very strong. This beautiful and rare bird is found on plains near the borders of rivers, in the province of Acra, in Guinea, and is said to live principally on the fruit of the plantain. Its total length is nineteen inches, of which the tail is six inches and one-third. It is described and figured in Latham's second supplement. Picæ.

Gen. 13. Glaucopis, *Wattle-bird*. 168 Glaucopis.

Bill incurvated, arched, the lower mandible shortest, with a caruncle below at the base; nostrils depressed, and half covered with a membrane nearly cartilaginous, cut at the point, and fringed; feet gressorial. 169 Characters.

Cinereous wattle-bird.—Body, bill, and legs black; caruncle first blue, then orange; irides blue, and very large; tail long and wedged; legs long; hind claws longer than the rest. Fifteen inches long; about the size of a jay. Inhabits New Zealand, where it is often seen walking on the ground, and sometimes, though more rarely, perching on treets. It feeds on various kinds of berries and insects, and even, according to some, on small birds. Its note approaches to whistling, and sometimes to a sort of murmuring that is not unpleasant. Its flesh is eatable, and by some esteemed savoury. 170 Cinerea.

Gen. 14. Corvus, *Crow*. 171 Corvus.

Bill strong, upper mandible a little convex, edges cultrated, and in most species, slightly notched near the tip; nostrils covered with bristles reflected over them; tongue divided at the end; toes, three forward, one backward, the middle one joined to the outer as far as the first joint. 172 Characters.

The greater number of this tribe are found in every climate. They are prolific, social, and clamorous; building on trees; laying six eggs; and living on grain, seeds, insects, &c. Some of them are apparently hurtful to agriculture; but their use in diminishing noxious vermin more than counterbalances the waste which they occasion.

Raven.—Black; back of a blueish-black; tail nearly rounded. Two feet two inches long. Varies with a few scattered white feathers, or is black and white, or entirely white. A well-known bird, a native of Europe, Asia, and America. Is hardy, cunning, voracious, and yet patient of hunger. Preys on young ducks and chickens, and even destroys young lambs and sickly sheep, by first picking out their eyes. Smells carrion at a great distance; gluts itself when an opportunity offers, retires to digest, and returns again to feed. Though easily domesticated, and taught to speak, it has a mischievous trick of purloining any thing glittering, and concealing it. "We have been assured (says Mr Montagu), by a gentleman of veracity, that his butler having missed a great many silver spoons and other articles, without being able to detect the thief for some time, at last observed a tame raven with one in his mouth, and watched him to his hiding place, where he found more than a dozen." The raven usually makes choice of the forks of the largest trees to build in; but many of them likewise breed on rocky coasts, and nestle in the most inaccessible parts of them. At this time they are very bold, and will not allow even the falcon to approach their nest with impunity. The male and female pair for life, and drive their young from their haunt, as soon as they are able to provide for themselves. The female lays five or six eggs of a blu- 173 Corax.

ish-green

Picæ. ish-green colour, blotched and spotted with brown and ash-colour, and somewhat larger than those of a crow.

174 Coronæ. *Carrion crow.*—Bluish-black; tail rounded; tail feathers acute. Varied with spottings of white, or entirely white; bill black, irides dusky, legs black. Distinguished from the rook by the bill, which is rather more convex towards the end, and by the reflected bristles at the base being always perfect. These marks, however, are obvious only in adults, and in young birds, the note is the only criterion, which in this is much more hoarse than that of the rook. This species weighs about nineteen ounces, and is eighteen inches long. It feeds on flesh, insects, and grain, but is particularly fond of carrion. It frequently attacks the eyes of dying animals, destroys weakly lambs, and when pressed with hunger, will even pursue birds on wing. It likewise makes havock among young game and poultry. It will frequently hide its food till hunger becomes more urgent. With the lesser species of hawks it wages constant war; nor will it suffer the kite, the buzzard, or the raven, to approach its nest with impunity. Carrion crows keep in pairs all the year, and seldom congregate but to regale on some carcase, or to roost in winter. They build in woods, on the branches of trees, making a nest of sticks, plastered with earth, and lined with some soft materials, as wool and hair. The eggs are four or five in number, of a greenish colour, spotted with dusky and ash.

175 Frugilegus. *Rook.*—Black; fore part of the head cinereous; tail somewhat rounded. Very like the preceding; but differs in its manners, being content with feeding on the insect tribe and grain. It is particularly fond of what is commonly called the *grub-worm*, which is the larva of the chaffer. The rook is gregarious at all seasons, resorting every spring to breed on the same trees, where their nests may be seen crowded one over another, on the upper branches. It lays four or five eggs, much like those of the crow. After their young have taken wing, they all forsake their nest-trees, but return to them again in October, to roost. On the approach of winter, they usually seek some more sheltered situation at night, but generally assemble first in the usual place, and then fly off together. Rookeries are sometimes the scene of violent contests between the old and new inhabitants An unfortunate couple of strangers will sometimes have their half-built nests torn in pieces, and be compelled to begin their work anew in some more undisturbed situation. "Of this (says Mr Bewick) we had a remarkable instance in Newcastle. In the year 1783, a pair of rooks, after an unsuccessful attempt to establish themselves in a rookery at no great distance from the exchange, were compelled to abandon the attempt. They took refuge on the spire of that building, and although constantly interrupted by other rooks, built their nest on the top of the vane, and brought forth their young, undisturbed by the noise of the populace below them; the nest and its inhabitants turning about with every change of the wind. They returned and built their nest every year on the same place till 1793, soon after which the spire was taken down." In England, rooks remain during the whole year; but both in France and Silesia they migrate. It is a singular circumstance, that the island of Jersey should be entirely without rooks; particularly when we know that they frequently fly over from Britain to France. The young birds, when skinned, and made into pyes, are much in request at some tables, but are nevertheless coarse eating.

176 Cornix. *Hooded crow*, or *royston crow.*—Ash-coloured; head, throat, wings, and tail black. Length twenty-one inches. Visits the south of England in October, and retires north to breed, in the beginning af April. In the Hebrides, and some parts of Scotland and Ireland, it is resident throughout the year. In open champaign districts, it feeds on grain, worms, and carrion; but it often resorts to the neighbourhood of the sea coast, where the various animal matters thrown up by the tide, afford a constant supply of food. It not only picks out the eyes of lambs and diseased sheep, but of horses, when entangled in bogs. The nest and eggs are similar to those of the common crow. It is not uncommon in many parts of Europe and Siberia.

177 Monedula. *Jackdaw.*—Brownish black; hind part of the head hoary; front, wings, and tail, black. Its varieties are, a white collar round the nack; white, with a yellowish bill; bright black, and eyes surrounded with white dots; black, with bill and legs red; wings white, bill somewhat curved; brownish, with white shoulders, &c. Weighs about nine ounces; length near thirteen inches. This very common bird frequents old towers, ruined buildings, and high cliffs, where it builds, as well as in holes of trees. The nest is made of sticks, and lined with wool and other soft materials; the eggs are five or six, and bluish, spotted with black. The jackdaw is gregarious, frequently flocks with rooks, and like the latter, feeds on grain and insects, is fond of cherries, and will devour carrion in severe weather. It is frequently seen to perch on the back of sheep, not only to rob that animal of its wool, as a lining to its nest, but also to pick out the ticks with which it is infested. Though easily made tame, and taught to speak, it is mischievous, and full of tricks.

178 Glandarius. *Jay.*—Wing-coverts blue, with white and black transverse lines; body variegated with purple and gray. This beautiful bird is very common in Great Britain, and in various parts of Europe and Siberia; frequenting wooded tracts, but not in flocks. It weighs seven ounces, and measures nearly thirteen inches in length. The nest, which is commonly built in high coppice wood, or hedges, and sometimes against the sides of a scrubby tree, is formed of sticks, lined with fibrous roots, and contains five or six eggs, of a light brown colour, not very unlike those of the partridge, but smaller, and obscurely marked with a darker shade of brown. The jay is a great devourer of fruit and grain, particularly acorns, peas, and cherries; will frequently plunder the nests of smaller birds of their eggs and young, and sometimes pounce on the old birds, on which it preys, as well as on mice. Its common notes are various, but harsh, and manifest a singular propensity to imitation and mimicry, counterfeiting the bleating of a lamb, the mewing of a cat, the cry of a kite or buzzard, the hooting of an owl, the neighing of a horse, &c. It has even been known to imitate very exactly the sound made by the action of a saw.

179 Cristatus. *Blue jay.*—Blue; collar black; wing-coverts with transverse black lines; crest blue; cheeks, chin, and belly, white; breast pale red; back pale purple; tail long, wedged, with black and blue lines, and tipt with white; legs black. Eleven inches long; inhabits North

Pica. North America; is gregarious; builds in marshy places; has a pleasant note; feeds on worms, serpents, chesnuts, &c. and is particularly destructive to the maize fields.

180 *Caryocatactes.* *Nut-cracker.*—Brown, dotted with white; wings and tail black; tail feathers black at the tip, the middle ones as if worn. Body with triangular white spots; vent white; crown and tail feathers without spots; feathers of the nostrils sometimes wanting; tongue bicuspidate. Length thirteen inches; size of a magpie. Inhabits Europe and Siberia, but is very rare in England. Its favourite food seems to be the kernels of nuts, which it hacks or splits with its bill.

181 *Pica.* *Magpie.*—Variegated black and white; tail wedged. Subject to considerable varieties. About eighteen inches long, and weighs between eight and nine ounces. Too well known to require particular description, being a common inhabitant of many parts of Europe, Asia, and America. Generally continues in pairs through the year; is mischievous and clamorous, and has a very indiscriminate appetite, rejecting hardly any species of animal food, or fruits, and devouring grain, when nothing else can be got. Is crafty and familiar; may be taught to pronounce words, and even short sentences, and will imitate any particular noise which it hears. Like other birds of its kind, is addicted to pilfering, and will hoard its provisions. The female builds her nest with great art, leaving a hole in the side for her admittance, and covering all the upper part with thorny branches, closely entangled, so as to secure her retreat from the rude attacks of other birds. The inside is furnished with a sort of mattress composed of wool, and other soft materials. She lays seven or eight eggs, of a pale green colour, spotted with black. During winter nights, magpies assemble in great numbers in some coppice or thicket, to roost, but separate again in the day.

182 *Mexicanus* *Mexican crow.*—Entirely bluish black. Bill, legs, and claws black. Size of the jackdaw. Inhabits New Spain, frequenting the neighbourhood of towns, and perpetually chattering with a strong and sounding voice.

183 *Pyrrhocorax.* *Alpine crow.*—Blackish; bill pale yellow, legs black. Size of the jackdaw; length fifteen inches. Inhabits the Alps and Pyrenees; has a sharp, disagreeable voice; lives on seeds and grain, and is injurious to corn fields. Its flesh is good eating.

184 *Graculus.* *Red-legged crow*, or *Cornish chough.*—Violet blackish; bill and legs red. Weighs about fourteen ounces; length nearly seventeen inches. Inhabits the Alps, Norway, England, Egypt, and Persia. In this island, it seems to be chiefly confined to Devonshire, Cornwall, and Wales. Mr Pennant observes, that it is also found in some parts of Scotland and the Hebrides. It is seldom seen at any great distance from the sea coast, where it breeds in the rocks and caverns, and not unfrequently in ruined towers. The nest is composed of sticks, and lined with a great quantity of wool and hair. The eggs are generally five, of a dull white, sprinkled with light brown and ash-coloured spots, mostly at the larger end. The note of the Cornish chough is somewhat like that of the jackdaw, but more shrill. Its food is grain and insects, though, in a state of confinement, it will greedily feed on flesh. It is easily tamed, but crafty, and will hide not only part of its food, but things of value. It is even alleged, that houses have been set on fire by its carrying off lighted sticks in its bill.

Gen. 15. Coracias, *Roller.*

Pica.

Bill sharp-edged, bent in at the point, base naked of feathers; tongue cartilaginous, and bifid; legs short; feet gressorial; toes three before, and one behind, divided to their origin. 185 Coracias. 186 Characters.

This genus is not confined to any particular region of the globe, as one or other of the different species may be met with in each of the four quarters of the world.

Common or *garrulous roller.*—Blue; back red; flag-feathers black.—The only species that has ever been met with in England, and that very rarely. Length twelve inches and a half; size of a jay. Vies with some of the parrots, in its shades of blue and green, mixed with white, heightened by the contrast of graver colours. It is wilder than the jay; frequents the thickest woods, and builds its nest chiefly on birch trees. It is plentiful in Germany, Sicily, and Malta, where they are sold in the markets and poulterers shops. It feeds on frogs, beetles, acorns, grain, and fruit, and in cases of necessity will even eat carrion. It is remarkable for making a chattering kind of noise. Its flesh tastes like that of a turtle. 187 Garrula.

Long-tailed roller.—Bill blackish, one inch and a half long; hind parts of the head green; upper parts of the back and scapulars fulvous glossed with green; lower part of the back, rump, and wing coverts, fine blue; upper tail coverts blue green; two middle feathers of the tail deep green, rest blue green; outer ones on each side twice the length of the others, and the projecting part deep blue; the shafts of all black; legs gray; claws blackish. Inhabits Angola. 188 Caudata. Plate CCCXCIV. fig. 1.

Docile or *tame roller.*—White, interspersed with reddish, bay beneath; legs yellow; tail feathers black, tipt with white; bill yellow; claws flesh-colour. Size of a jackdaw. Inhabits Persia; and has obtained its name from imitating the words and actions of those around it. 189 Docilis.

Noisy roller.—Black; patch on the wings; vent, base, and tip of the tail white. This species is very numerous at Norfolk island; and is very clamorous, especially at night. It is a very foolish bird; running after any person, and allowing itself to be knocked down with a stick. It is about nineteen inches long, and rather bigger than a jackdaw. 190 Strepera.

Gen. 16. Oriolus, *Oriole.* 191 Oriolus.

Bill conical, convex, very acute and straight; upper manible somewhat longer than the under, and slightly emarginated; tongue bifid and acute; feet gressorial. 192 Characters.

The birds of this genus are gregarious, noisy, numerous, voracious, and great devourers of corn. They chiefly inhabit America, and often build pendulous nests. The only European species, which also inhabits Asia and Africa, is the

Golden oriole, or *golden thrush.*—Pale yellow; lores and limbs black; outer tail feathers yellow on the hind part; bill and irides yellow; legs plumbeous. Nine inches and a half long. Inhabits Europe, Asia, and Africa; and is incident to several varieties. It is by no means uncommon in France, where it summers and breeds. Its nest is in the shape of a purse, fastened to the extreme divarications 193 Galbula.

divarications of the outmost twigs of tall trees, and composed of fibres of hemp, or straw, mixed with fine dry stalks of grass, and lined within with moss and lichens. The female lays four or five eggs of a dirty white, marked with small brown spots. She sits three weeks, and will not unfrequently suffer herself to be taken with the eggs and nest, and continue to sit on them in a cage, till she dies. The golden oriole is partial to grapes, figs, cherries, berries, and insects. It has a loud cry. Its flesh is reckoned good eating.

194 Picus. *Climbing oriole.*—Tawney; head, neck, and breast spotted with white; tail rounded; bill yellowish gray; legs blackish. Seven inches long. Inhabits Guiana, among trees, which it climbs like a pie, and picks out insects from under the bark.

195 Icterus. *Icteric oriole.*—Tawney; head, throat, back, quill and tail feathers, black; wings with a white spot; bill mostly black, with a brown base; irides yellowish; legs sometimes black and sometimes lead coloured, or gray white. Nine inches and a half long. Inhabits the warmer parts of America and the Carribee islands. Domesticated for the purpose of killing insects. In its wild state it is very agile and bold. It builds a large cylindrical nest, suspended to the end of a twig of a tree, with a view to defend its young from the attacks of snakes and other animals. Of these nests several may sometimes be seen near to one another, and not far from houses.

196 Phæniceus. *Red-winged oriole.*—Black; wing coverts tawney. Size of a starling; length from eight to nine inches. Occurs in Mexico, the Carolinas, Virginia, and as far as New York. Builds a thick pensile nest among reeds, or between the forks of trees, three or four feet from the ground, along with other birds, in the swamps, which are seldom accessible by man. In Louisiana these birds appear only in winter, and sometimes in such immense flocks, that three hundred or more are taken at one draught of the net. These nets are spread on some bare smooth path, at the side of a wood, with rice strewed to decoy the birds. To secure the multitudes that are caught, it is often necessary to knock most of them on the head upon the spot. Their common name in America is *maize-thief*, which they have acquired from the circumstance of their pecking a hole in the plant when green, and so destroying it.

197 Americanus. *Red-breasted oriole*, or *mocking-bird of Guiana.*—Black; chin, throat, breast, and upper corner of the wings red. Seven inches long, less than a blackbird. Inhabits Guiana and Cayenne; sings pleasantly, and imitates the notes of many other birds. The nest, which is built of hay, &c. is long, cylindrical, twelve or fifteen inches in circumference, and hangs from the high branches of the tallest trees.

198 Persicus. *Black and yellow oriole.*—Black; hind part of the back, spot on the wing-coverts, and base of the tail feathers, yellow. There are, however, several varieties. Bigger than a blackbird. Inhabits South America; forms a pendent nest, shaped like an alembic: four hundred of which may sometimes be seen together, hanging from the extreme branches of trees. The eggs are dirty white, with small pale brown spots.

199 Baltimorus. *Baltimore oriole*, or *Baltimore bird.*—Blackish; the under parts of the body, and band on the wings tawney; bill lead colour; greater wing coverts black, tipt with white; first quill feathers dirty white, edged with white; two middle tail feathers black, the rest black on the lower part, and orange above. These birds are found in many parts of America, the northern regions of which they occupy in summer, advancing even to Montreal in May, and returning southward in winter, which accounts for their appearance in Maryland and Virginia at that time. They make their nest of a soft downy matter, in the shape of a purse, tying it with threads to the extreme forks of the twigs of the tulip, plane, and hiccory trees. The country people call them *fire-birds*; and indeed, when in high plumage, their motions from branch to branch not unaptly resemble a flash of fire.

Weaver oriole.—Yellow; head brown, with a shade of golden; quill and tail feathers blackish, edged with orange. Inhabits near the Senegal; size of the golden oriole. "In the cage where these birds were kept (says Dr Latham), it was observed, that they entwined some of the stalks of the pimpernel, with which they were fed, in the wires; as this seemed to shew a disposition of making a nest, some rush-stalks were put into the cage; on which they presently made a nest large enough to hide one of them at least; but it was as often deranged as made, the work of one day being spoiled the next; serving to shew that the fabrication of the nest in a state of nature was the work of both male and female, and in all probability is finished by the last. They had a sharp but lively note. 200 Textor.

"A friend of mine described a bird to me, which he saw at the house of an acquaintance, which seemed to be this very bird. By accident having got a bit of sewing silk, it wove it among the wires of the cage, on which, more being put to it, it interlaced the whole very confusedly, so as to hinder most part of that side of the cage from being seen through. It was found to prefer green and yellow to any other coloured silk."

Banana oriole.—Tawney; head and breast chesnut; back, quill, and tail feathers, black. Seven inches long. Inhabits South America and the West India islands. Makes a nest of a curious construction, composed of fibres and leaves, exactly in the shape of the fourth part of a globe, sewed with great art under a leaf of a banana tree, in such a manner that the leaf forms one side of the nest. 201 Banana.

Hang-nest oriole, American hang-nest, Spanish nightingale, &c.—Frontlet and wreath black; crown, neck, back, and tail, reddish-brown; breast and belly tawney yellow. Inhabits the woods in Jamaica; sings sweetly; and builds a pendulous nest of stalks or thready moss, on the extreme branch of a high tree. 202 Nidipendulus.

Gen. 17. GRACULA, *Grakle*. 203 GRACULA.

Bill convex, sharp-edged, somewhat naked at the base; tongue entire, somewhat sharp, fleshy; feet formed for walking. 204 Characters.

All the species are extra-European; have a thick bill, compressed at the sides, with small nostrils at the base, and sharp hooked claws; the middle toe of the fore-feet connected at the base to the outer.

Minor, or *religious grakle.*—Violet black; spot on the wings white; hind-head with a yellow naked band. Size of a blackbird; length ten inches and a half. Inhabits 205 Religiosa.

Picæ. habits various parts of the East Indies; is very fond of cherries and grapes; and can be easily trained to whistle, sing, or speak.

206 Barita. *Boat-tailed grakle.*—Grayish; shoulders blue; quill feathers green on the outside. Size of a cuckoo, nearly thirteen inches long. The folding up of the tail feathers, instead of forming a plane surface at top, sinks into a hollow, like a deep gutter, which singularity is manifest only when the bird is flying, or perched, for when on the ground, it always carries its tail expanded. It inhabits Jamaica and North America, keeping company with the maize-thief and red-winged oriole. It feeds on maize, the fruit of the banana, &c. as well as on beetles and other insects.

207 Quiscala. *Purple grakle.*—Violet black; tail rounded. Upwards of thirteen inches long, though the female measures only eleven and a half. Inhabits Mexico, the warm parts of America, and Jamaica; sings sweetly; feeds on all kinds of grain, and makes great havock in the maize plantations. It lays five or six bluish eggs, with black stripes and spots.

208 Paradisea.

Gen. 18. Paradisea, *Bird of Paradise.*

209 Characters. Bill covered with a belt of downy feathers at the base; feathers of the sides very long; two of the tail feathers naked. Legs and feet very large and strong; three toes forward, one backward, the middle connected to the outer one as far as the first joint.

The birds of this genus, till lately, were very imperfectly known, and had given rise to various idle tales, such as their never alighting on the ground from their birth to their death; their living entirely on dew; their being produced without legs, &c. The circumstance which led to the last-mentioned error, was merely accidental; the legs and coarser parts of the wings having been pulled off in the course of preparing the birds for an ornamental article of dress. Though the birds of paradise occur in Japan, China, Persia, and various parts of India, they are believed to be properly natives of New Guinea, where they breed. The Dutch get them chiefly from Banda, where the story of their want of legs has been propagated, in order to enhance their value.

210 Apoda. *Great bird of Paradise.*—Feathers of the hypochondria longer than the body; the two intermediate tail feathers long and setaceous; the size of the body scarcely exceeds that of a thrush, though the plumage would indicate a bird as large as a pigeon; the length from the end of the bill to that of the tail is twelve inches and a half; the bill is greenish yellow, and an inch and a half long; the eyes are very small; the head, which is also small in proportion to the bird, as well as the throat and neck are covered with very short, dense, stiff feathers, of which those on the head and hind part of the neck are of a pale gold colour; the base of the bill is surrounded with black feathers, appearing like velvet, and changing in different lights to green; the fore part of the neck is golden green; the lower part of the neck behind the back, wings, and tail, are chesnut; the breast is of a deep chesnut, verging to purple; from under the wings proceeds a great quantity of feathers, with the webs so loose, as to appear like a herring-bone, some of them nearly eighteen inches long, some chesnut and purplish, others yellowish, and a few almost white; from the rump arise two feathers without webs, except for four inches next the base, and the same at the tips; the legs are stout and of a brown colour. These birds are found in the Molucca islands, and those surrounding New Guinea, particularly in Aroo, where they arrive with the westerly or dry monsoon, and whence they return to New Guinea, when the easterly or wet monsoon sets in. They are seen going and returning in flights of thirty or forty, conducted by a leader, which flies higher than the rest. During this flight they cry like starlings. By a sudden shifting of the wind, their long scapular feathers are sometimes so dishevelled as to preclude flying, when they fall to the ground, or are lost in the water. In the former case they cannot rise again into the air, without gaining an eminence, and are secured by the natives, and killed on the spot, as they cannot be preserved alive by art. They are likewise caught with bird-lime, or shot with blunt arrows, or intoxicated with the berries of *menispermum cocculus* put into the water which they are accustomed to drink. Their real food is not known with certainty. According to some, they feed on the red berries of the *waringa tree* (*ficus benjamina*), according to others, they are particularly fond of nutmegs; some assert that they live on large butterflies, and others, that they chase and devour small birds. It is only for ornament that they are coveted by such of the inhabitants of the east as are able to purchase them, the chiefs of the country wearing them constantly in their turbans. The grandees of Persia, Surat, and the East Indies, use them as aigrettes, and even adorn their horses with them. There is a lesser variety of this species, found in the Papua islands. 211

King's bird of Paradise, or *king's bird.*—Chesnut purple, whitish beneath; two middle tail-feathers filiform, feathered, and semilunar at the tips; breast bluish; cirri of the tail very long; feathers under the wings longer than the rest; tail short, truncate; from five to seven inches long, and about the size of a lark. It is said not to associate with any others of the bird of paradise, but shifts solitary from bush to bush in quest of red berries, and never gets on tall trees. It occurs in the islands of the Indian ocean, and returns to New Guinea in the rainy season, but is much more scarce than the preceding. Regia. 212

Magnificent bird of Paradise.—Chesnut brown above; chin green, with golden lunules; crown with a tuft of yellow feathers; first quill-feathers brown, secondary deep yellow; middle tail-feathers very long, with a very short fringe; legs and bill yellow, and the latter black at the tip and base. A singular and beautiful species, figured in Latham's Synopsis. Magnifica. 213

Gorget bird of Paradise.—Black, slight green beneath; hind head, nape, crown, and band on the middle of the belly fine green, a splendid gold-coloured crescent under the chin; tail feathers 12, unequal, the outer ones five inches long, and the two in the middle 22. Twenty-eight inches long. Figured in Latham's Synopsis. Nigra. 214

Superb bird of Paradise.—Crested; head, crown, and belly green; chin violet, silky; wings black; tail with a shade of green; bill black; legs brown; under the wings a tuft of loose, black, silky feathers, as long as the wings when folded. Eight inches and eight lines long. Native of the northern parts of New Guinea. Superba.

White

Picæ. *White bird of Paradise.*—Entirely white. Inhabits the Papuan islands, and is very rare.

215 Alba.

216 Trogon.

Gen. 19. Trogon, *Curucui.*

217 Characters. Bill shorter than the head, sharp-edged, hooked; mandibles serrated at the edge; feet scansorial; body long; nostrils covered with bristles; feet short, woolly; tail very long, consisting of 12 feathers.

The birds of this genus are all inhabitants of the tropical regions, and mostly inhabit South America. They live solitary, in the thickest recesses of moist woods, sitting and building on the lower branches of trees. They take but a short flight, and feed on insects and fruit. As they differ much in appearance, in different stages of life, a considerable degree of confusion has prevailed in the illustration of the species. They have the name of *curucui* from their note.

218 Curucui. *Red-bellied curucui.*—Of a greenish-gold colour, tawney beneath; throat black; lateral tail feathers, with white and black bars, the middle ones tipt with black. Somewhat less than a magpie; length 10 inches and a half. Inhabits Mexico, Brazil, and Peru. There are two or three varieties. At pairing time, only two or three are found together; and the male has a kind of melancholy note, by which their haunts are discovered. They begin to pair in April, and build in the hole of a rotten tree, laying three or four white eggs, about as big as those of a pigeon, on the bare rotten dust. During the incubation of the female, the male takes care to provide food for her, and to beguile the time by his song. The parents feed the young with small worms, caterpillars, and insects; and, when their nurslings are able to shift for themselves, they forsake them, and return to their solitary haunts, till nature prompts them to produce their second brood in August or September. Various attempts have been made, but without effect, to domesticate this species, as it obstinately refuses food, when in confinement.

219 Bucco.

Gen. 20. Bucco, *Barbet.*

220 Characters. Bill cultrated, compressed laterally; apex emarginated on both sides, and incurved, gape reaching below the eyes; nostrils covered with recumbent feathers; feet scansorial; bill strong, somewhat straight, almost covered with bristles; tail feathers usually ten.

The birds of this genus are all inhabitants of Africa, and the warmer parts of Asia and America, and are a dull and stupid race.

221 Tamatia. *Spotted-bellied barbet.*—Tawney brown, tawney white, spotted with black beneath; chin tawney; neck with a tawney lunule varied with black, a black spot behind the eyes; head very large; bill black; crown and front tawneyish; legs black. This bird occurs both at Cayenne and Brazil. It is clumsy, solitary, silent, and pensive, affecting only such places as are farthest from habitations, generally in the woods, where it chooses some low branch, well covered with twigs and foliage, on which it perches, with its large head resting between its shoulders for a long time together, allowing itself to be shot at several times before it makes its escape. It feeds on insects, particularly large beetles.

222 Elegans. *Beautiful barbet.*—Green; head and chin red, edged with blue; quill feathers brown, throat and breast yellow, the latter spotted with red; belly yellow, spotted with green; bill, legs, and claws cinereous, the latter tipt with yellow; a blue streak on each side of the mouth; tail wedged; quill feathers edged with green. Size of a sparrow, nearly six inches long. Inhabits the country of Maynas, on the borders of the Amazons, and is the most beautiful and active of the tribe. Picæ.

Gen. 21. Cuculus, *Cuckoo.* 223 Cuculus.

Bill smooth, weak, a little curved; nostrils bounded by a small rim; tongue arrowed, short, and pointed; feet scansorial. 224 Characters.

Of upwards of 50 species belonging to this genus, the first mentioned only is a native of Great Britain; and very few of the others are natives of Europe.

Common cuckoo.—Cinereous, whitish beneath, transversely streaked with brown; tail rounded, blackish, dotted with white; edges of the eyelids, opening of the mouth and palate saffron; when young, the whole body is brownish, the feathers edged with white; the upper part of the body is sometimes varied with reddish. It likewise occurs with wavings of gray; a double row of white dots on the middle tail feathers, and the bill, orbits, and legs of a sulphur colour. Size of the turtle dove; 14 inches long, and weighs about four ounces and a half. The female is rather less, and, in general, differs from the other sex, in the neck and breast being of a tawneyish brown, barred with dusky, and the wing-coverts marked with light ferruginous spots. Inhabits Europe, Asia, and Africa.—This well-known bird comes to us early in the spring, and almost invariably leaves us by the first of July, though the females may sometimes remain a little later, till they have deposited all their eggs. Such as are seen about the latter end of September or beginning of October, are the young of that year, or stragglers which have been wounded. The singular note of the male has given rise to the name of this bird, in most languages; the female is either silent, or makes only a chattering noise. Cuckoos build no nest, and what is more extraordinary, the female deposits her solitary egg in the nest of another bird, by which it is hatched. The nest which she selects for this purpose is usually that of the hedge sparrow, though sometimes also that of the water-wagtail, tit-lark, yellow hammer, green linnet, &c. Dr Jenner, in his valuable communication to the Royal Society, published in the second part of the 78th volume of their Transactions, observes, that while the hedge sparrow is laying her eggs, which generally takes up four or five days, the cuckoo contrives to deposit her egg among the rest, leaving the future care of it entirely to the hedge sparrow. This intrusion often occasions some discomposure, for the old hedge sparrow at intervals, while she is sitting, not only throws out some of her own eggs, but sometimes injures them in such a way, that they become addle; so that it frequently happens that not more than two or three of the parent bird's eggs are hatched with that of the cuckoo: and, what is very remarkable, it has never been observed, that the hedge sparrow has either thrown out or injured the egg of the cuckoo. When the hedge sparrow has sat her usual time, and has disengaged the young cuckoo and some of her own offspring from the shell, her own young ones, and any of her eggs that remain unhatched, are soon turned out; the young

225 Canorus.

Picæ. young cuckoo then remains in full possession of the nest, and is the sole object of the future care of its foster-parent. "The mode of accomplishing this (says the ingenious and interesting inquirer, in reporting his observations on a particular case), was curious; the little animal, with the assistance of its rump and wings, contrived to get the bird upon its back, and making a lodgement for its burden, by elevating its elbows, clambered backwards with it up the side of the nest till it reached the top, where, resting for a moment, it threw off its load with a jerk, and quite disengaged it from the nest. After remaining a short time in this situation, and feeling about with the extremities of its wings, as if to be convinced that the business was properly executed, it dropped into the nest again." Dr Jenner made several experiments in different nests, by repeatedly putting in an egg to the young cuckoo, which he always found to be disposed of in the same manner. But we are reluctantly compelled to withhold various other interesting details relative to this subject, and to refer our readers to the original communication. The young birds are observed to be helpless and foolish for a great length of time, but are capable of being tamed, and, when in confinement, will eat bread and milk, fruits, insects, eggs, and flesh, either cooked or raw; but, in a state of nature, they live chiefly on caterpillars and insects.

226 *Vetula.* *Long-billed rain cuckoo.*—Tail wedged; body brownish, testaceous beneath; eyelids red. Rather bigger than a blackbird. Inhabits woods and shrubberies in Jamaica, is easily tamed, flies short, sings before rain, and feeds on grains, insects, worms, small serpents, frogs, lizards, and small birds.

227 *Pluvialis.* *Rain cuckoo.*—Olive ash, rufous beneath; chin and throat white; outer tail-feathers edged with white. From 16 to 17 inches long, like the preceding. Inhabits Jamaica, and sings before rain. Both species are familiarly known by the names of *old man*, and *rain bird*.

228 *Ridibundus.* *Laughing cuckoo.*—Tawney; chin, throat, and breast cinereous; belly, thighs, and lower tail-coverts black; bill bluish black; irides white; tail half as long as the body. Sixteen inches long. Inhabits New Spain; has a voice like a man laughing, on which account it is dreaded by the Indians as ominous.

229 *Melanoleucos.* Plate CCCXCIV. fig. 4. *Coromandel crested cuckoo.*—Upper parts of the body black; under part white; a white spot on the edge of the wing; tail wedge-shaped and tipped with white; head crested; bill black; legs brown. Length eleven inches. Inhabits the coast of Coromandel.

230 *Pisanus.* *Pisan cuckoo.*—Tail wedged; body above varied with white and black, white beneath; head black and crested; chin and breast rufous. Rather larger than the common species, and has its name from having been once caught in Pisa.

231 *Indicator.* *Bee cuckoo, honey-guide, moroc,* &c.—Rusty gray, white beneath; eyelids naked, black; shoulders with a yellow spot; tail wedged, rusty; bill brown at the base, and surrounded with bristles, yellow at the tip; feathers of the thighs white, with a longitudinal black streak; quill-feathers brown above, gray brown beneath; first tail-feathers very narrow, rusty; the next sooty, the inner edge whitish; the rest brown at the tip on the inner web. Somewhat larger than the common sparrow. Native of the interior parts of Africa. This bird is very fond of honey and bee maggots; but being unable, by its own efforts, to procure them from the hollow of trees, it points out to man and to the animal called *ratel*, the nests of wild bees. The morning and the evening are its principal meal times; at least it is then that it shews the greatest inclination to come forth, and with a grating cry of *cherr, cherr, cherr*, to excite the attention of the ratel, as well as of the Hottentots and colonists. Somebody then generally repairs to the place whence the sound proceeds, when the bird, continually repeating its cry, flies on slowly and by degrees to the quarter where the bees have taken up their abode. The persons thus invited, follow accordingly, taking great care, at the same time, not to frighten their guide by any unusual noise; but rather to answer it now and then with a very soft and gentle whistle, by way of letting the bird know, that its call is attended to. When the bees nest is at some distance, the bird often makes long stages, or flights, waiting for its sporting companions between each flight, and calling to them again to come on; but it flies to shorter distances, and repeats its cry more frequently, and with greater earnestness, in proportion as they approach nearer the nest. When the bird has sometimes, in consequence of its impatience, got too far a-head of its companions, but particularly when, on account of the unevenness of the ground, they have not been able to keep pace with it, it will fly back to meet them, and, with redoubled cries, denoting still greater impatience, upbraid them, as it were, for being so tardy. When it arrives at the nest, whether the latter is built in the cleft of a rock, or in a hollow tree, or in some cavity of the earth, it hovers over the spot for a few seconds, then sits in silence, and for the most part concealed, in some neighbouring tree or bush, in expectation of the result, and with a view of receiving its share of the booty. Nor is it disappointed; the hunters, by way of acknowledgement, leaving it a considerable portion of that part of the comb in which the bees are hatching. Mr Barrow corroborates these details, and adds, that the moroc intimates to the inhabitants, with equal certainty, the dens of lions, tigers, hyænas, and other beasts of prey, and noxious animals. Le Vaillant mentions that the Hottentots are very partial to this bird on account of its services, and that once when he was on the point of shooting one, they intreated him to spare its life. Mr Bruce, by confounding this species with another peculiar to Abyssinia, has indulged in some very misplaced strictures on the accounts of Sparrman and Lobo.

Gen. 22. Yunx. 232 Yunx.

Bill smoothish, cylindrical, pointed, a little curved, weak; nostrils concave, naked; tongue very long, smooth, worm-shaped, armed at the point; tail feathers 10, flexible; feet scansorial. 233 Character.

This genus consists of only one species, and has, by most authors, been held distinct; for, though allied to some other genera, it perfectly coincides with none. The tongue and disposition of the toes correspond to those of the woodpecker; but the weakness of the bill distinguishes it from that family. It seems also to be nearly related to the cuckoo, did not its length of tongue form a marked distinction.

Wryneck.—Gray, varied with brown, and blackish; 234 *Torquilla.* belly reddish, with blackish spots; tail-feathers waved with

with black spots, streaks, and bars. Description, however, is very inadequate to convey an accurate idea of the elegant markings of this little bird. Its name seems to have been given it from the singular manner of turning its head over its shoulder and perpetually looking about, when the black list on the back of the neck gives it a twisted appearance. The weight of this beautiful bird is about ten drams, and its length seven inches. It inhabits Europe, Asia, and Africa, appearing in Britain about the same time with the cuckoo, and chiefly frequenting woods, or thickly inclosed countries, where trees or orchards abound. Its food principally consists of ants and other insects, of which it finds great abundance lodged in the bark and crevices of trees, and which it secures by a horny substance at the end of its long tongue. It likewise frequents ant hills, into which it darts its tongue and draws out its prey. It is never seen with any other society than that of its female, and as soon as the domestic union is dissolved, which is in September, they retire and migrate by themselves. It makes an artless nest of dry grass, on dusty rotten wood, in holes of trees, and lays nine or ten eggs, which are white aud transparent. If surprised in its nest, it stretches itself at full length; and erecting the feathers on the crown of its head, suddenly rises, making, at the same time, a short hissing noise, like that of a turkey cock. In the beginning of spring, it very frequently repeats a noise like that of the smaller species of hawks.

235 Picus.

Gen. 23. Picus, *Woodpecker*.

236 Characters. Bill angular, straight, wedged at the tip; nostrils covered with recumbent setaceous feathers; tongue round, worm-shaped, very long, bony, missile, daggered, beset at the point with reflexed bristles; tail feathers ten, hard, rigid, pointed; feet scansorial.

The birds of this genus climb trees, particularly those that are decaying or dead, in search of insects and their larvæ. The bone of their tongue terminates in two long slender cartilages, which proceed from below upwards, and from behind forwards, over the whole skull, under the skin, and are attached to the forehead near the base of the bill. By means of those elastic cartilages, the woodpeckers thrust out their filiform tongue to catch insects. The feet are formed for climbing, their tail is fitted for resistance and support, and their sharp-pointed and barbed tongue enables them to extract insects from their lurking places in trees. They are therefore unjustly persecuted and driven from plantations. They make their nests in hollows of trees. They have a membranous stomach, and want the cæcum.

237 *Martius.* *Great black woodpecker*.—Black, cap vermilion. In the female the hind head only is red; length 17 inches and a half. Size of a jackdaw; bill nearly two inches and a half long, of a dark ash colour, and whitish on the sides; irides pale yellow. Has all the habits of the green woodpecker, and is a great destroyer of bees. Makes its nest deep in some tree, which it has excavated for the purpose, and lays two or three white eggs; a circumstance which seems peculiar to most of the genus. Occurs in Europe, Siberia, and Chili; but rarely visits England.

238 *Erythrocephalus.* *Red-headed woodpecker*.—Head wholly red; wings and tail black; belly white. Eight inches and three quarters long, and weighs two or three ounces. This species inhabits Virginia, Carolina, Canada; &c.; but on the approach of winter, migrates more or less to the southward, according to the severity of the season, from which circumstance the North Americans foretel the rigour or clemency of the ensuing winter. The red-headed woodpeckers are very destructive to maize fields and orchards, and are fond of acorns. During the winter, they are very tame, and sometimes come into houses, as the redbreast with us. They are found chiefly in old trees; and the noise that they make with their bills may sometimes be heard at a mile's distance.

Gold-winged woodpecker.—Striated transversely with black and gray; chin and breast black; nape red; rump white. Chin of the female cinereous; length 11 inches; weight five ounces. Inhabits North America; is almost continually on the ground; feeds on worms and insects; and, in default of these, on berries and grass. When fat, is esteemed good eating. 239 *Auratus.*

Green woodpecker.—Green; crown of the head crimson; bill dusky, two inches long; inner circle of the irides reddish; outer white; temples blackish; quill feathers dusky, with whitish spots; tail blackish, obscurely barred with green, and tipt with white; legs greenish ash. Weighs about six ounces, and is thirteen inches long. Inhabits Europe, and is by no means uncommon in the wooded parts of England. It feeds on insects, and is particularly fond of bees. It is frequently seen climbing up a tree, or on the ground, in the neighbourhood of an ant hill. The hole which they make is as perfect a circle as if it had been described by a pair of compasses. It is curious to observe them try every part of a dead limb of a tree, till they have discovered the most sonorous, and then the strokes are reiterated with such velocity, that the head is scarcely perceived to move. The softer wood, such as the elm, ash, and asp, are, for the most part, attacked, for the purpose of nidification, and are perforated only where they exhibit symptoms of decay. The excavations are often deep, to give security to the eggs, which are generally four or five, and placed on the rotten wood without any nest. 240 *Viridis.*

Downy woodpecker.—Back longitudinally downy; outer tail feathers white, with four black spots. Weighs an ounce and a half, and measures only five inches and a half in length. Inhabits Carolina, Virginia, New Jersey, &c. and is a daring bird, and dangerous to orchards. As soon as it has pecked one hole in a tree, it makes another close to the first, in a horizontal direction, proceeding till it has made a circle of holes quite round the trunk, so that the tree frequently dries up and decays. 241 *Pubescens.*

Hairy woodpecker.—Back somewhat downy, in a longitudinal direction; outer tail feathers entirely white. From nine to twelve inches long. Like the former, is the pest of orchards. Inhabits North America, from Hudson's Bay to Carolina; and likewise occurs in the north of England. 242 *Villosus.*

Greater spotted woodpecker.—Variegated with black and white; hind head and vent red. Female, without red on the hind head. The weight of this species is about two ounces and three quarters, and the length nine inches. The bill is dusky, and an inch and a quarter long; the irides are reddish brown. Inhabits Europe, North America and Siberia. It is less frequent in England than the green species, to which it is nearly allied. 243 *Major.*

Picæ. allied in manners and habits, except that it rarely descends to the ground in search of food. Lays four or five white and glossy eggs on the decayed wood, without any formal preparation of a nest.

244 Medius. *Middle spotted woodpecker.*—Variegated with white and black; vent and cap red; cheeks white; three lateral tail feathers, tipt with white. Supposed by some to be only the young of the preceding species.

245 Minor. *Lesser spotted woodpecker.*—Variegated with white and black; crown red; vent testaceous or brick-coloured. There are two or three varieties. The weight of this small species is not quite five drams; and the length is about five inches and a half. Inhabits Europe and Asia, and has the habits of the *major*; but is of more rare occurrence.

246 Minutus. *Minute woodpecker.*—Chesnut gray; whitish, waved with brown beneath; crown red; hind head black, spotted with white. Only three inches and a half long, the least of its tribe. Inhabits Cayenne.

247 Cardinalis. Plate CCCXCIV. fig. 3. *Cardinal woodpecker.*—Black; under part of the body white, spotted with black; crown and back part of the head red; wings spotted with white; legs and bill blackish. Inhabits the isle of Luzonia.

248 SITTA.

Gen. 24. SITTA, *Nuthatch.*

249 Characters. Bill subulated, roundish, unbent, projecting straight forwards, and entire; the upper mandible somewhat longer than the under, compressed at the point; tongue notched, short, and horny at the apex; nostrils small, covered with bristles; feet gressorial.

The general manners of the whole of this genus are supposed to correspond with those of the ensuing species, which is the only one that is found in Britain.

250 Europæa. *European nuthatch.*—Cinereous, reddish beneath; tail feathers black, the four lateral ones beneath tipt with white. A black line through the eyes and ears; rump white, varied with rusty; the first tail feather with a white bar, two with a white spot, three or four tipt with white, five colour of the back. Inhabits Europe and Asia. Remains in England the whole year; but is local, and chiefly affects wooded and inclosed situations, selecting the deserted habitation of a woodpecker for its nest. The hole is first contracted by a plaster of clay, leaving only sufficient room for the bird to pass in and out. The nest is made of dead leaves, especially of those of the oak, which are heaped together without much order. The number of eggs is six or seven, and they are scarcely to be distinguished from those of the great titmouse, in size and markings. If the plaster at the entrance be destroyed when there are eggs in the nest, it is speedily replaced, to prevent the intrusion of the woodpecker and other birds of superior size which build in the same situation. No persecution will force this little bird from its habitation when sitting. It defends its nest to the last extremity, strikes the invader with its bill and wings, makes a hissing noise; and, after every effort of defence has been practised in vain, will suffer itself to be taken in the hand rather than desert its charge. The nuthatch is more expert in climbing than the woodpecker; for it runs in all directions up and down a tree. When employed in breaking a nut, its favourite position is with the head downwards. In the autumn it is no uncommon thing to find, in the crevices of the bark of an old tree, a great many broken nut shells, the work of this bird, which repeatedly Picæ. returns to the same spot for this purpose. When it has fixed the nut firm in a chink, it turns on all sides, to strike it with most advantage. This, with the common hazel-nut, is a work of some labour; but it breaks a filbert with ease. In default of nuts, this bird searches for insects and their larvæ among the moss on trees and old thatched buildings. It is commonly met with among orchards, and is sometimes seen, in the cyder season, picking the seeds from the refuse of the pressed apples. In spring it has a remarkably loud, shrill whistle, which ceases after incubation, and gives place, in autumn, to a double reiterated cry. It deserves to be remarked, that the singular jarring noise produced by some species of woodpeckers, by repeated strokes of the bill against the decayed limb of a tree, has been erroneously ascribed to the nuthatch. 251

Surinam nuthatch.—Reddish chesnut, dirty white beneath; middle of the back white; wings and tail black; Surinamensis. wing and tail coverts tipt, and secondary quill feathers edged, with white. Only three inches and a half long. Inhabits Surinam.

Gen. 25. TODUS, *Tody.* 252 TODUS.

Bill subulate, somewhat depressed, obtuse, straight, covered at the base with bristles; nostrils small, oval; feet gressorial. 253 Characters.

These mostly inhabit the warmer regions of America, and are nearly related to the family of fly-catchers; but are distinguished from them by having the middle and outer toe much connected, which, in the fly-catchers, are divided to the base. 254

Green tody.—Green; yellowish rosy beneath; breast Viridis. red; upper mandible brown, lower orange; irides chesnut; cheeks with a red spot; legs and claws gray. The male, according to Buffon, has the upper part of the body of a pale blue, the belly white, the breast and sides rose colour. This pretty species, which is about the size of a wren, and four inches long, occurs not only in the warmer parts of the American continent, but also in St Domingo, Jamaica, and other islands of the West Indies. The females are not uncommon in Jamaica. It is supposed to feed on soft insects, and is of a shy solitary disposition, frequenting the lonely parts of moist tracts of country, where it is observed to sit all of a heap, its head drawn in between its shoulders, and so stupid as almost to allow itself to be taken by the hand. 255

White-headed tody.—Black; subcrested head and Leucocephalus. chin white; bill blackish; the lower mandible white, tipt with blackish; wings short; tail even. Less than the redstart. Inhabits America. Figured in Latham's Synopsis. 256

Obscure tody.—Olive brown, yellowish-white be- Obscurus. neath; crown, quill, and tail feathers blackish. Size of the hedge sparrow. Inhabits North America, where it feeds on insects. Frequents the decayed parts of trees, and has all the actions of the fly-catcher. It has an agreeable note, two or three times repeated, but not what can be called a song. 257

King tody.—Blackish brown, reddish beneath; crest Regius. chesnut, spotted with white at the tip; chin and eyelids white; bill dusky brown; breast with transverse blackish lines; legs flesh colour. This singular and beautiful species

Picæ. species measures seven inches in length. Inhabits Cayenne, and is very rare.

258 Platyrhyncos. *Broad-billed tody.*—Yellowish-brown, yellow beneath; chin and spot on the crown white; wings and tail brown; bill very large and broad. Size of the nightingale. Figured by Latham.

259 Cristatus. Plate CCCXCV. fig. 3. *Crested tody.*—Crest scarlet; body brown, spotted with white; wing coverts spotted with white; feathers of the crest tipped with black. Native of Guinea.

260 Alcedo.

Gen. 26. Alcedo, *King's-fisher.*

261 Characters. Bill triangular, thick, straight, long, and acuminated; the tongue fleshy, very short, flat, and acute; feet, for the most part, gressorial.

The birds of this genus are dispersed over the whole globe; though it is supposed that only one species inhabits Europe. Most of them frequent rivers and the vicinity of waters, and live on fish, which they catch with singular art and dexterity. Sometimes they hover over the water, where a shoal of small fishes is seen playing near the surface; at other times, they wait with attention on some low branch, hanging over the water, for the approach of a single one, which is so unlucky as to swim that way. In either case they drop like a stone, or rather dart with rapidity on their prey. They seize the latter cross-ways in their bill, retire to a resting place to feed on it, devour it piecemeal, bones and all; and afterwards bring up the indigestible parts in pellets. The wings of most of this genus are very short; yet the birds fly rapidly, and with great strength. In their colours, blue of different shades predominates. Their nostrils are small, and generally covered.

262 Cristata. Plate CCCXCV. fig. 5. *Crested king's-fisher.*—Bill black; an inch and a half long; crown feathers long, forming a crest, of a greenish colour, and barred with black; a fine blue stripe on each side of the neck; upper part of the body bright blue; upper wing coverts violet, and each feather tipped with a bright blue spot; legs and claws reddish; length nearly five inches. Inhabits Amboyna and the Philippine islands.

263 Formosa. *Splendid king's-fisher.*—Tail short; body yellowish-green; shoulders, throat, and rump yellow; wings and crown of the head blue; bill yellowish-horn colour; head with a bright yellow stripe on each side; smaller wing coverts edged with yellow; legs reddish-brown. A beautiful species, which inhabits South America.

264 Ispida. *Common king's-fisher.*—Tail short; body blue above, orange-coloured beneath; lores red; bill black; crown and wing coverts green, with blue spots; tail of a beautiful blue; irides and legs red. In the female the bill is not so long as in the other sex. Frequents running streams and rivers, in the banks of which it generally takes possession of a rat's hole to deposit its eggs. This hole is ascending, and generally two or three feet in the bank; at the end is scooped a hollow, at the bottom of which is a quantity of small fish-bones, nearly half an inch thick, mixed with the earth, and which are probably the castings of the parent bird, as they are found even before they have eggs. On this disgorged matter the female lays to the number of seven eggs, which are perfectly white and transparent, and of a short oval form. Before the young are able to fly, the hole becomes extremely fetid by the fæces of the brood, which cannot be carried away by the parent birds, as is common with most of the smaller species. As the old birds have nothing in their bill, when they go in to feed their young, it has been inferred, that they eject from the stomach for that purpose. When the young are nearly full feathered, they are extremely voracious, and may be discovered by their constant chirping. This species is reckoned the most beautiful of all the British birds, weighs one ounce and a quarter, and measures seven inches in length. It inhabits Europe, Asia, and Africa. It was formerly believed, that if the body of this bird was suspended by a thread, some magnetic influence always turned its breast to the north. This, however, is as fabulous as the tradition, that its stuffed skin will preserve woollen cloth from the depredations of moths. There is a variety found in Senegal, about six inches and a half long, blue green varied with brown above, tawney beneath, and chin yellowish.

265 Alcyon. *Belted king's-fisher.*—Tail long, crested, bluish; belly white; breast ferruginous; a white spot before and behind the eyes; bill black; chin white; breast with a ferruginous band on the fore part; thighs rusty; shanks very short; legs brown; outer toe connected with the middle toe. Eleven inches long. Inhabits Carolina, and feeds on lizards and fish. It is subject to several permanent varieties, which occur in different parts of America.

266 Amazona. *Amazonian king's-fisher.*—Glossy green; under parts of the body and lunule on the neck white; sides variegated with green; tail spotted with white; bill and legs black. Thirteen inches long. Inhabits Cayenne.

267 Tuta. *Respected king's-fisher.*—Tail long; body olive above, white beneath; eyebrows white; collar greenish black. Bill black; lower mandible white. Legs black. Eight inches and a half long. Native of the Society islands, where it is held sacred by the inhabitants, as are the species denominated *venerata* and *sacra.*

268 Fusca. *Great brown king's fisher*—Crested, olive above, whitish and obscurely striated beneath; temples and hind head dirty white; tail rounded with rusty and steel-blue lines, and tipt with white. The female has no crest. Eighteen inches long. Inhabits New Guinea.

269 Cancrophaga. *Crab-eating king's fisher.*—Tail long; body blue-green, yellowish-tawney beneath; band through the eyes; wing coverts and tips of the quill-feathers black. Twelve inches long. Inhabits Senegal, and feeds on crabs.

270 Egyptia. *Egyptian king's-fisher.*—Brown, with rusty spots; whitish, with cinereous spots beneath. Size of the Royston crow. Inhabits Lower Egypt, about Cairo; builds in sycamore and date trees, and feeds on frogs, insects, and small fish, which last it meets with in the fields when they are flooded. Its cry approaches to that of the common crow.

271 Galbula.

Gen. 27. Galbula, *Jacamar.*

272 Characters. Bill straight, very long, quadrangular, pointed; nostrils oval, at the base of the bill; tongue short, sharp-pointed; thighs downy on the fore part; feet scansorial.

This is much allied to the preceding; but the toes are differently placed, namely, two before and two behind. The food of the jacamar is likewise different, as it feeds on insects alone; and, for that purpose, frequents moist woods.

Picæ. woods. Only four species have been described, and scarcely any information has hitherto been obtained relative to their economy and manners.

273 Grandis. *Great jacamar.*—Copper gold above, ferruginous beneath; head and limbs green gold; tail wedged, and longer than the body. Size of the green woodpecker. Native country unknown.

274 Paradisea. *Paradise jacamar.*—Two middle tail feathers very long; body golden green; throat and wings white beneath; bill and legs black; head violet brown; tail much wedged. Inhabits Cayenne and Surinam; is 11 inches and a half long; flies in pairs; is less solitary than its congeners, and feeds on insects.

275 Merops.

Gen. 28. Merops, *Bee-eater*.

276 Characters. Bill curved, quadrangular, compressed, carinated, pointed; nostrils small, at the base of the bill; tongue slender, the tip generally jagged; feet gressorial.

The birds of this genus, with a few exceptions, inhabit the old continent. Their general food is insects, and they are particularly fond of bees and wasps. They have no note beyond a whistle, and that far from agreeable. Like the king's-fisher, they breed in holes in the banks of rivers.

277 Apiaster. *Common bee-eater.*—Back ferruginous; belly and tail bluish-green; two of the tail feathers longer than the others; chin pale yellow; bill black; irides red; front blue green; crown, hind head, and neck, bay; a black streak from the bill to the hind head; tail wedged, the feathers edged inwardly with cinereous; legs chesnut; claws reddish black. A variety sometimes occurs with the bill convex and uncarinated, and the toes unconnected at the last joint. The common bee-eater measures 10 inches from bill to tail. It inhabits various parts of Europe, Asia, and Africa; and is very plentiful in the southern parts of Russia, particularly about the rivers Don and Wolga. In the third volume of the Linnean Transactions an account is given of one of this species having been shot, for the first time, in Britain, near Mattishal, in Norfolk, in July 1794. A flight of about 20 was seen in June; and the same flight, as was supposed, much diminished in number, was observed passing over the same spot in October following. They feed, on the wing, upon bees, gnats, flies, and other insects; or, in defect of these, upon seeds. Their nest is composed of moss, and the eggs, from five to seven, are perfectly white, and about the size of those of a stare. They are gregarious and migratory, quitting the colder latitudes, in great flocks, in autumn. When the sun shines on them, in their flight, they are a pleasing object, as they appear gilded. Kolben remarks, that they guide the Hottentots to the honey, which the bees lay up in the clefts of the rocks.

278 Viridis. *Indian bee-eater.*—Green; band on the breast black; chin and tail blue; two of the tail feathers longer than the others; bill and band across the eyes black; legs brown. There are several varieties. Eight inches and a half long. Inhabits India.

279 Superbus. *Superb bee-eater.*—Red; front, throat, and rump, blue; two middle tail feathers longer than the others. Nine inches long.

280 Carunculatus. *Wattled* or *New Holland bee-eater.*—Brown; belly yellow; wattles carunculated; tail wedged, tipt with white; bill black; nostrils pervious, and half covered with a membrane; crown blackish; a silvery stripe at the angle of the mouth; a long, orange, pendent caruncle behind the base of the lower mandible; legs brownish, the outer toe connected at the base to the middle one. Fourteen inches and a half long. Inhabits New Holland; is pretty numerous on the sea shores of that country; chatters incessantly; is very bold; feeds on insects, and sucks the honey from the different sorts of Banskia.

Horned or *knob-fronted bee-eater.*—Brown; head somewhat naked; under parts of the body and tips of the tail feathers whitish; a blunt short eminence, like the rudiment of a horn, on the fore head. Size of a missel thrush. This singular species also inhabits New Holland, and is well figured in White's Journal. 281 Corniculatus.

Red-winged bee-eater.—Under part of the body of an olive or dirty-white colour; throat yellow; wings and tail red, tipt with black; bill one inch long, black; legs black. Six inches long. Inhabits Senegal. 282 Erythropterus. Plate CCCXCV. fig. 1.

Gen. 29. Upupa, *Hoop*, or *Hoopoe*. 283 Upupa.

Bill arched, long, slender, convex, a little compressed, somewhat obtuse; nostrils small, at the base of the bill; tongue obtuse, entire, triangular, very short; feet gressorial. 284 Characters.

Of the species included under this genus, the first only is found in Britain. They feed on insects, haunt dunghills, and are, in general, uncleanly in their manners.

Common hoop.—Variegated with blackish and rufous white, beneath; crest pale orange, tipt with black; tail black, with a white band; bill and legs black; irides hazel; back and wings with black and white lines; neck reddish-brown; crest of a double row of feathers; tail feathers 10. The weight of this beautiful bird is about three ounces, and the length 12 inches. Inhabits Europe, Asia, and Africa; but only visits this country, occasionally, in autumn, and is very seldom known to breed with us. The female is said to have two or three broods in the year. Seldom makes a nest; but lays her eggs, which are generally four or five, bluish-white, and marked with pale brown spots, in the hollow of a tree, and sometimes in a hole of a wall, or even on the ground. Its food consists chiefly of insects of the beetle tribe. It is a solitary bird, two of them being seldom seen together. In Egypt, where they abound, they are seen only in small flocks. Its crest usually falls behind on its neck, except when it is surprised or irritated, and then it stands erect; the tail, too, being, in that case, usually erected, and spread like a fan. 285 Epops.

Grand hoop, or *grand promerops.*—Black; head, neck, and breast, glossy green; scapular and lateral tail feathers falcated; tail very long. "This most extraordinary and beautiful bird (observes Dr Latham), is near four feet in length, from the top of the bill to the end of the tail; the body is the size only of a middling pigeon, though much elongated in shape. The bill is three inches long, pretty much curved, and black; the head, hind part of the neck, and upper part of the belly, are of a shining green; the fore part of the neck, and lower part of the belly, without gloss; the scapular feathers are of a singular construction; the webs on one side of the shaft being exceeding short, and on the other of a great length; the shape of them falciform: they 286 Magna.

Picæ. they are of a purplish black colour, with the ends, for three quarters of an inch, of a most brilliant gilded glossy green, though some of them, in a different light, reflect a blue gloss; beneath each wing arises a thick tuft of feathers, eight inches and a half in length, and of a texture resembling the herring-bone ones in the *greater bird of Paradise;* and, besides these, on each side of the tail are five or six falciform feathers, with unequal webs, as the scapulars, though not half so much curved; the colour half dusky, half greenish brown; the last divided from the other colour, on each feather, in an oblique manner; the tail consists of 12 feathers, and is of an enormous length, the middle ones measuring no less than 28 inches; but each of the others shortens as it proceeds outwards, to the outer one of all, which is only five inches in length; the colour of all of them is blue black, with a polished steel gloss in some lights; the legs are black." Dr Latham has annexed a coloured figure. Little else is known of this remarkable species, except that it inhabits New Guinea.

287 Erythrorhynchos. *Red-billed hoop.*—Black green; belly black; tail wedged; six first quill and lateral tail feathers spotted with white; bill and legs red; feathers of the head and neck silky, and somewhat downy. Fifteen inches long. Inhabits Asia and Africa. Figured by Latham.

288 Certhia.

Gen. 30. Certhia, *Creeper.*

289 Characters. Bill arched, slender, somewhat triangular, pointed; tongue various, though generally pointed; feet formed for walking.

The birds of this genus are spread over the globe. They live chiefly on insects; their nostrils are small; their tail is composed of 12 feathers; their feet are large, with a large back toe; their claws are long and hooked. Most of them have an acute tongue; though in some it is flattened at the point, in others ciliated, in a few tubular. There are a considerable number of species, of which only one is a native of Britain.

290 Familiaris. *Common creeper.*—Gray; white beneath; quill feathers brown, ten of them with a white spot; head and neck brown, with black streaks; rump tawney; wing coverts varied brown and black; quill feathers dusky, tipt with white, edged and barred with tawney; breast and belly silvery; tail long, tawney, the feathers sloping off to a point. Weighs about two drams; length five inches. Inhabits Europe, Asia, and America. Runs with great facility on all sides of small branches of trees, in search of insects and their eggs, which constitute its food. Except the crested wren, it is the smallest of British birds; and though pretty common, is not seen without difficulty, from the ease with which on the appearance of any one, it escapes to the opposite side of the tree. Its nest is composed of dry grass and the inner bark of wood, loosely put together, and lined with small feathers; and it is usually constructed in some hole, or behind the bark of a decayed tree. The eggs are from six to eight, white, and minutely speckled with bright rust colour. During incubation, the female is fed by the other sex. The note of the common creeper is weak, monotonous, and deliberately uttered, but rarely heard in winter.—In North America, is found a variety of a considerably larger size.

291 Coccinea. *Hook-billed red creeper.*—Scarlet; wings and tail black; bill longer than the head, bent like a scimitar, legs and long claws blackish; tail feathers short, pointed; edges of the wings, and roots of the throat feathers, white. This beautiful species inhabits the Sandwich islands, and is much used by the natives in their feathered dresses. Picæ.

Mocking creeper.—Olive; crown inclining to violet; spot on the cheeks white; wings and subforked tail brown. Seven inches long. Inhabits New Zealand; has a very imitative voice, and sips the sweet moisture from the nectaries of flowers. 292 Sannio.

Cardinal creeper.—Black; head, neck, breast and line down the middle of the back, red; tail even. Size of the common species. Inhabits the island of Tanna, and sucks the nectaries of flowers. 293 Cardinalis.

Wall creeper, or *spider-catcher.*—Cinereous; wings with a tawney spot; bill subulate, sharp edged, longer than the head; neck whitish beneath; quill feathers black; wings with a rosy spot; tail feathers whitish; claws strong, particularly the hind one. The chin and throat of the female are white. Size of a sparrow, length six inches eight lines. Inhabits southern Europe and Asia. Is solitary; feeds on insects, and has the same manners as the common creeper, except that it haunts ruined edifices, old walls, arches, &c. and is particularly fond of spiders. According to Scopoli, it migrates singly towards the end of autumn. Its flight is vague and uncertain, and it climbs by leaps. Builds frequently in holes of walls. 294 Muraria.

Little brown and white creeper.—Brown; white beneath; eyebrows white; tail feathers brown, the outer ones white at the tip; a black streak from the bill to the eyes; quill feathers edged with a brassy hue. Three inches and a half long. Inhabits India. Feeds on flies, and is fond of honey. 295 Pusilla.

Blue creeper, or *certhia of Guiana.*—Blue; band across the eyes, chin, wings, and tail, black. Four inches long, and somewhat bigger than the common creeper. Makes its nest of dried stalks or grass, in the form of a retort, and open beneath, suspending it from the slender and extreme branches of trees, and thus securing it against the attacks of the monkey, snake, and lizard.—Varies, in having the bill and legs sometimes red. 296 Cærulea.

Collared creeper.—Glossy green; breast red, with a steel-blue bar on the fore-part. Four inches and a half long. Inhabits the Cape of Good Hope; feeds on insects and the nectar of flowers, and sings sweetly. 297 Chalybea.

Black and yellow creeper, *yellow-bellied creeper*, &c. —Black; pale yellow beneath; eyebrows whitish; outer tail feathers tipt with white. The markings, however, vary considerably. From four to five inches long. Inhabits the West Indies, and feeds principally on the juice of the sugar cane, which it draws out by insinuating its bill into any crevice or crack of the stalk. 298 Flaveola.

Braceletted creeper.—Green; wings, when folded, black above; beneath yellow; shoulders, bracelets on the thighs, and spots on the rump, sapphire blue; bill black; legs yellowish; body beneath whitish-green; vent yellowish; quill feathers black, inner edge yellow. Length five inches. Native of Surinam. 299 Armillata. Plate CCCXCIV. fig. 1.

Orange-backed creeper.—Bluish-gray; spot on the back, and under parts of the body yellow; bill and legs black; irides red. Three inches long. Inhabits China, and is remarkable for the sweetness of its song. 300 Cantillans.

Beautiful

Picæ.

301 *Pulchella* *Beautiful creeper.*—Two middle tail feathers very long; body glossy green; breast red; bill, legs, and tail feathers, blackish, the latter edged with gold; belly whitish; wings and greater coverts brown. Seven inches long. Inhabits Senegal.

302 *Famosa.* *Famous creeper.*—Two middle tail feathers very long; body glossy green; armpits yellow; lores black; bill, legs, claws, and tail black; a black line between the bill and eyes. Female green brown; yellowish beneath; breast green; two middle tail feathers shorter than in the male. Nine inches long. Inhabits the Cape of Good Hope.

303 *Lotenia.* *Loten's creeper.*—Blue; bar on the breast gold-red; lores black; bill subulate, black, twice as long as the head; tongue compressed at the tip; head, neck, back, rump, and upper tail coverts, sometimes blue, sometimes gold-green; breast, belly, and vent glossy black; in the female dirty white, spotted with black; wings black; lesser coverts violet; middle green; greater black; tail even. Upwards of five inches long. Inhabits Madagascar and Ceylon. Makes a cup-shaped nest, like that of a chaffinch, of the down of plants. The female generally lays five or six eggs. This species is sometimes chased by a very voracious spider, as large as itself, which seizes on the whole brood, and sucks the blood of the young birds.

304 Trochilus.

Gen. 31. Trochilus, *Humming bird.*

305 Characters. **Bill subulate, filiform, tubular at the tip, longer than the head; upper mandible sheathing the lower; tongue filiform, the two threads coalescing, and tubular; feet gressorial.**

The birds of this species are very small, and, with a very few exceptions, inhabit South America. Their bill and feet are weak, their nostrils minute, and their tongue is capable of being darted far out. They fly very rapidly, take their food on the wing, sucking the honey juice of flowers, and sometimes also swallowing insects, the fragments of which have been found in their stomachs. They are bold, pugnacious, and gregarious, and make a louder noise by the motion of their wings than by their voice. They construct an elegant hemispherical nest of the down of a species of thapsus, and suspend it from the branches of trees, where it is hid by the leaves, the female laying two white eggs of the size of peas, which are batched by the alternate incubation of the male and female. These minute birds are taken by aspersing them with water from a syphon, as the finest shot would blow them to pieces. They are said to hybernate. The brilliancy of their colouring greatly exceeds the powers of painting and description. The green, red, and blue of their diminutive plumage is like beaten gold, and reflects the most beautiful splendour in sunshine.

A. *Bill curved.*

306 *Paradiseus.* *Paradise humming bird.*—Red; wings blue; head crested; middle tail feathers very long; bill and legs black; wing coverts blue. Eight inches and a half long. Inhabits Mexico.

307 *Exilis.* *Little humming bird.*—Greenish-brown, with a scarlet gloss; wings and tail black; crest green at the base, tipt with gold; bill black. One inch and a half long. Inhabits Guiana.

Picæ.

Topaz humming bird.—Red; middle tail feathers very long; head brown; chin gold-green; rump green; bill, head, and neck black; breast rosy; back and wing coverts orange red; quill and middle tail feathers purple; the rest orange. Female almost entirely green gold. Six inches long. Inhabits Surinam. 308 *Pella.*

Mango humming bird.—Glossy green; tail nearly equal, and ferruginous; belly black, bill and legs black; a blue line dividing the colours of the back and belly; vent white; two middle tail feathers black. Four inches long. Inhabits Mexico, Brazil, and St Domingo. According to Albinus, it is also found in Jamaica, building its nest of cotton in the physic-nut-tree, and laying two white eggs as big as peas. There are several varieties. Under this species, Dr Latham relates the following interesting particulars. 309 *Mango.*

"We have before related a circumstance of the possibility of keeping humming birds alive for some time, by means of sugar and water; but this was in their own country and climate. In addition to this, we have been informed, on undoubted veracity, of the following fact: A young gentleman, a few days before he set sail from Jamaica to England, was fortunate enough to meet with a female humming bird, sitting on the nest and eggs; when, cutting off the twig, he brought all together on board the ship; the female became sufficiently tame, so as to suffer itself to be fed with honey, and during the passage hatched two young ones; however, the mother did not survive long, but the young were brought to England, and continued alive for some time in the possession of Lady Hammond. Sir H. Englefield, Baronet, and Colonel Sloane, both witnesses of the circumstance, informed me that these little creatures readily took honey from the lips of Lady Hammond, with their bills: one of them did not live long, but the other survived at least two months from the time of its arrival."

B. *Bill straight.*

Red-throated humming bird.—Green gold; tail feathers black, the three lateral ones ferruginous, tipt with white; chin flame colour; bill black; chin scarlet, with a beautiful gold gloss. The female brown above, whitish beneath; tail subequal, rusty at the base, and tipt with white. Three inches and one-fourth long. Inhabits America, as far north as Canada. This beautiful little creature flies so swiftly, that the eye is incapable of pursuing it, and the motion of its wings is so rapid as to be imperceptible to the nicest observer. It never feeds but on the wing, suspended over the flower from which it extracts its nourishment. Like the bee, having exhausted the honeyed juice of one flower, it wanders to the next, in search of new sweets. It is most partial to those flowers which have the deepest nectaries: and, in the countries which these birds inhabit, whoever sets plants of this description before his window, may depend on being visited by multitudes of them. It is very entertaining to see them swarming around the flowers, and trying every tube by thrusting in their bills. If they find that their companions have anticipated them, and robbed the flower of its honey, they will frequently, in a fit of rage, pluck it off, and throw it on the ground, or even tear it in pieces. Numbers will sometimes contend very fiercely for the possession of the same flower. During the conflict, they frequently pursue the fugitives into the apartments of those houses whose windows are left 310 *Colubris.*

Picæ.

left open, take a turn round the room as flies do with us, and then suddenly regain the open air. When feeding, they will allow persons to come within two yards of them; but, on a nearer approach, they dart off with wonderful swiftness. The red-throated humming bird most frequently builds on the middle of a branch of a tree, and the nest is so small, that it cannot be seen by a person who stands on the ground. It is quite round; the outside, for the most part, composed of the green moss common on old pales and trees, and the inside of the softest vegetable down which the birds can collect. Sometimes, however, they vary the texture, using flax, hemp, hairs, and other similar materials. They are sometimes, likewise, known to fix it on some low bush, on a stalk of the tobacco plant, or even on the side of a pod of ocra (*Hibiscus esculentus*, Lin.). The female lays two eggs, which are white, and equal in thickness at both ends. When these birds observe any one climbing the tree in which they have their nests, they attack him in the face, attempting to strike him in the eyes, and coming, going, and returning, with such swiftness, that one would scarcely credit it who had not seen it himself. This species, like the others of its genus, is seldom caught alive. A friend of Monsieur du Pratz had, however, this pleasure. He had observed one of them enter into the bell of a convolvulus; and, as it had quite buried itself to get at the bottom, he ran immediately to the spot, shut the flower, cut it from the stalk, and carried off the bird a prisoner. He could not, however, prevail on it to eat; and it died in the course of two or three days. Charlevoix informs us, that he had one of them in Canada, for about twenty-four hours. It suffered itself to be handled, and even counterfeited death, that it might escape; but it fell a real sacrifice to a slight frost during the night. "My friend Captain Davies informs me (says Dr Latham), that he kept these birds alive for four months by the following method:—He made an exact representation of some of the tubular flowers, with paper fastened round a tobacco pipe, and painted them of a proper colour. These were placed in the order of nature, in the cage in which the little creatures were confined: the bottoms of the tubes were filled with a mixture of brown sugar and water as often as emptied; and he had the pleasure of seeing them perform every action; for they soon grew familiar, and took their nourishment in the same manner as when ranging at large, though close under the eye."

311 *Moschitus.* *Ruby-necked humming bird.*—Green-gold; tail even and ferruginous, the two outer feathers tipt with brown; wings black; bill and legs blackish; crown, hind head, and neck ruby; body brown beneath. Female whitish gray beneath, with a gold spot on the breast and throat. Upwards of three inches long. Inhabits Guiana, Brazil, and Surinam. Reputed the most beautiful of the tribe.

312 *Mellivorus.* *White bellied humming bird.*—Tail feathers black, the lateral ones white; head blue; back green; belly white. Above four inches long. Inhabits Surinam. Edwards remarks, that the whole of the plumage, in the sun, seems as if mixed with threads of gold.

313 *Minimus.* *Least humming bird.*—Green; whitish beneath; lateral tail feathers white on the outer edge; bill and legs blackish; wings violet brown; tail feathers bluish-black, the primary totally gray; secondary gray from the middle to the tip. Female dirty greenish-brown, whitish beneath. Inhabits South America, and some of the West India islands. The least of all known birds; being hardly an inch and a quarter in length, and weighing from twenty to forty-five grains; thus being surpassed in weight and dimensions by more than one species of bee. The female is even less than the male.

Order III. ANSERES. 314 Anseres.

Bill somewhat obtuse, covered with a skin, gibbous at the base; mouth toothed; tongue fleshy; feet palmated, and formed for swimming. 315 Characters.

Most of the birds belonging to this order dwell much in the water. Their feet and legs are short, concealed under the feathers, and placed more behind than in other birds. Their toes are short, and generally compressed, so that they easily cleave the water, and by means of their membranes or webs, form, as it were, broad oars. Their plumage is thicker, closer, and better furnished with down than that of other birds. The gland which all birds have at the rump, and from which they express an oily matter to preserve their feathers moist, is most considerable in the anseres, and contributes to make their plumage impermeable to water. They feed on fish, aquatic animals, and plants. In general they are polygamous, and make their nests among reeds, or in moist places. The young are soon able to seek their own food; yet the mother leads and protects them for some time, and the male frequently kills them. For the most part they lay many eggs; and the flesh of many is eatable, though it frequently savours of oil, or of fish.

Gen. 32. Anas. 316 Anas.

Bill convex, obtuse, the edges divided into lamellated teeth; tongue fringed and obtuse; the three fore toes connected, the hind one solitary. 317 Characters.

This is a very numerous genus, and includes swans, geese, and ducks.

A. *Bill gibbous at the base.*

Wild swan, hooper, elk, whistling swan, &c.—Bill semicylindrical, and black; cere yellow; body white; eyelids naked, yellow; legs black; ribs eleven. This is obviously a distinct species from the common or mute swan, being of a smaller size, and having the windpipe differently constructed. It weighs from fifteen to twenty-five pounds, and measures nearly five feet in length. It inhabits Europe, Asia, and America, affecting chiefly the northern regions of the globe, and seldom appearing in England, except in hard winters. On the approach of spring, they quit their southern stations, and again retire northward to breed. A few indeed drop short, and perform that office by the way, halting in some of the Hebrides, Orkneys, Shetland, or some solitary island. But the great bodies of this species occur on the large rivers and lakes near Hudson's bay, and those of Kamtschatka, Lapland, and Iceland. They are said to return to the latter place in flocks of about a hundred at a time, in spring; and also to pour in on that island from the north, in nearly the same manner, on their way southward, toward the close of autumn, flying very high in the air, and in such a compact body, that the bill of one touches the tail of another. The young, which are 318 Cygnus.

are bred there, remain throughout the first year; and in August, when they lose their feathers, and are unable to fly, the natives kill them with clubs, shoot, and hunt them down with dogs, by which they are easily caught. The flesh is highly esteemed, as are the eggs, which are gathered in the spring. The Icelanders, Kamtschatkadales, and other inhabitants of the northern world, dress their skins with the down on them, sew them together, and convert them into various sorts of garments. The northern American Indians have recourse to the same expedient for clothing themselves, and sometimes weave the down as barbers do the cawls for wigs, and then manufacture it into ornamental dresses for the women of rank, while the larger feathers are formed into caps and plumes, to decorate the heads of their chieftains and warriors. They likewise gather the feathers and down in large quantities, and barter or sell them to the inhabitants of more civilized nations. Notwithstanding the fabulous accounts and poetical descriptions of the song of the dying swan, its voice is shrill, harsh, and piercing, not unlike the sound of a clarionet, when blown by a novice in music. It is asserted, however, by those who have heard the united and varied voices of a numerous assemblage of them, that they produce a more harmonious effect, particularly when softened by the murmur of the waters. At the setting in of frosty weather, wild swans are said to associate in prodigious multitudes, and, thus united, to use every effort to prevent the water from freezing; which they are enabled to accomplish for a considerable length of time, by constantly stirring and dashing it with their extended wings. The wild swan has been styled "the peaceful monarch of the lake," because, conscious of his superior strength, he fears no enemy, nor suffers any bird, however powerful, to molest him, at the same time that he preys on none of the feathered tribe. His vigorous wing shields him against the attacks even of the eagle, and his blows from it are so powerful, as to stun or kill the fiercest of his foes. His food consists of the grasses and weeds, and the seeds and roots of plants which grow on the margins of the water, and of the myriads of insects which skim over or float on its surface; occasionally, too, of the slimy inhabitants within its bosom. The female makes her nest of the withered leaves and stalks of reeds and rushes, and commonly lays six or seven thick shelled, white eggs. The incubation is said to last six weeks. Both male and female are very attentive to their young, and will suffer no enemy to approach them.

319 Olor. *Tame swan.*—Bill semicylindrical, black; cere black; body white. The plumage of this species is of the same snowy whiteness as that of the preceding, and the bird is covered next the body with the same kind of fine soft down; but it is of a larger size, and is furnished with a projecting, callous, black tubercle, or knob, at the base of the upper mandible. But the most remarkable distinction consists in the conformation of the windpipe, which, in the present species, enters at once into the lungs, so that the utmost noise the bird can utter, is a mere hiss: whereas, in the wild species, the windpipe first enters the chest a little way, is then reflected in the form of a trumpet; after which it enters a second time, when, dividing into two branches, it goes on to join the lungs. The manners and habits of both species in the wild state are very similar. The beauty, graceful motion, and majesty of this bird, when it is wafted along a piece of water, attract the admiration of every beholder: but, out of the liquid element, the elegance of its form in a great measure disappears. While the male and female are employed with the cares of the young brood, it is not safe to approach them; for they will fly on a stranger, and sometimes beat him to the ground by repeated blows. Notwithstanding, however, their great strength of wing, a slight blow on the head will dispatch them. Multitudes of this species are found in Russia and Siberia, as well as farther southward, in a wild state. They occur, without an owner, on the Trent, on the inlet of the sea near Abbotsbury in Dorsetshire, and on some other rivers and lakes, in different parts of the British isles. Those on the Thames have, for ages, been protected as royal property; and it is still reckoned felony to steal their eggs. In former times great numbers were reared for the table: but they are now reckoned by most a coarse kind of food. A fattened cygnet, however, is still accounted a great delicacy, and usually fetches upwards of a guinea in the poultry market. It is generally believed that the swan lives to a great age, though the term of three centuries, assigned to it by some authors, is certainly much exaggerated. The female nestles among the rough herbage near the water's edge, lays from six to eight large white eggs, and sits on them about as many weeks before they are hatched. The young do not acquire their full plumage till the second year. If kept out of the water, and confined to a court-yard, the swan soon becomes dirty, dull, and spiritless. Its usual food consists of fish and water plants.

320 Atrata. *Black swan.*—Black; wings edged with white; bill red; upper mandible blackish at the tip, a yellow spot near the lip; legs black; feet paler. Extent of wing four feet eight inches. Inhabits various parts of New Holland; but little is known respecting its manners.

321 Hyberborea. *Snow goose.*—Body snow-white; front yellowish; ten first quill feathers black; bill and legs red. Size of a goose; length two feet eight inches; extent of wing three feet and a half; weight between five and six pounds. Great numbers of this species occur about Hudson's bay; visit Severn river in May, and stay a fortnight, but go farther north to breed. They return to Severn Fort about the beginning of September, and stay till the middle of October, when they depart for the south, and are observed in immense flocks attended by their young. At this time many thousands are killed by the inhabitants, who pluck and eviscerate them, and put them into holes in the earth, where they are preserved quite sweet by frost, throughout the severe season. These birds seem also to occupy the west side of America and Kamtschatka. In the summer months they are plentiful on the arctic coast of Siberia; but never migrate beyond 130° of longitude. They are supposed to pass the winter in more moderate climes, as they have been seen flying over Silesia; probably on their passage to some other country, as it does not appear that they continue there. Those of America, in like manner, winter in Carolina. The Siberians decoy them by a person covered with a white skin, and crawling on all fours, whom they are stupid enough to mistake for their leader, and whom they follow, when driven by men in their rear, till he entangles them in nets, or leads them into a sort of pond prepared for the purpose.

322 Antarctica. *Antarctic goose.*—Snowy; bill black; legs yellow. The

Anseres. The female has the tail flesh-coloured, and the body brown, with transverse white lines. From twenty four to twenty-six inches long. Inhabits Falkland islands.

323 Leucoptera. *Bustard goose.*—White; two middle tail feathers, primary quill feathers, and greater wing coverts, black; nape, and upper part of the back, with numerous black lines; wings with a blunt spine at the flexure, and a dusky green spot; greater wing coverts tipt with white; secondary quill feathers half black, half white; legs black. This is the *sea-goose* of Clayton, and the *white-winged antarctic goose* of Brown. It measures from thirty-two to forty inches in length, stands pretty high on its legs, walks and flies with great ease, and has not that disagreeable cackling cry peculiar to the rest of its kind. It generally lays six eggs; and its flesh is reckoned wholesome, nourishing, and palatable. Inhabits the Falkland islands.

324 Cinerea. *Loggerhead goose*, or *racehorse duck.*—Cinereous; dusky beneath; vent white; wings and tail short and black; bill, irides, and tubercle on the wings and legs, yellow. Length thirty-two inches; weighs from twenty to thirty pounds. Observed on Falkland islands, Staaten Land, &c.; mostly in pairs, though sometimes in large flocks. From the shortness of their wings, they were unable to fly, but they used them in the water as oars, and swam so rapidly, that it was very difficult to shoot them when on that element. In order to catch them, the sailors would surround a flock with boats and drive them on shore, where, unable to raise themselves from the ground, they ran very fast; but soon growing tired, and squating down to rest, were easily overtaken and knocked on the head. Their flesh, however, was not much relished, being rank and fishy.

325 Tadorna. *Sheldrake*, or *burrow duck.*—Bill turning up at the point; forehead compressed; head greenish black; body white and variegated; bill and legs red; head and neck violet; collar white; back white; breast brown; belly white, with a black line; first quill feathers black, the next violet, inner ones ferruginous, the last white; tail white, tipt with black. The female has less vivid colours. This elegant species of duck weighs about two pounds and a half, and measures about two feet three inches. It inhabits Europe and Asia, and is not uncommon on many parts of our coasts, remaining all the year. The female makes choice of a rabbit burrow, wherein to deposit her eggs, which are numerous, amounting sometimes to sixteen, and which she covers with down from her own body. The nest is generally near the water, whither the female leads her young soon after they are hatched. This species is rarely met with remote from salt water; but if the eggs are taken and hatched under a hen, the young become tame, and may be kept in ponds. They very seldom breed when in a state of confinement. Their principal food consists of sea-weeds, small shell-fish, and marine insects. The flesh is rancid

326 Fusca. *Velvet duck.*—Blackish; lower eyelid and spot on the wings, white; bill yellow, black in the middle, gibbous at the base; legs red. Female without the gibbosity on the bill, and body blackish. From 20 to 22 inches long. Inhabits Europe and South America. It is sometimes, though not often, seen on our coasts in winter. Frequents Hudson's bay, where it breeds in summer; and is not uncommon in Russia and Siberia. Lives on fuci and shell-fish. The female makes its nest of grass, and lays from four to 10 white eggs. The catching of this species is a favourite diversion of the Tungusi, who dwell on the river Ochota, and who chase great numbers of these birds, during the moulting season, into shallow water, and then knock them down with clubs. They take many of them alive, and, thrusting a needle through their eyes, carry fifty or more on a string. It is alleged that the birds, thus treated, will live for two or even three days. Anseres.

Scoter, or *black diver.*—Body quite black; bill gibbous at the base; head and neck sprinkled with purple; tail somewhat wedged. Female of a browner hue, and without the protuberance at the base of the bill. Length 22 inches; feeds on grass and shell-fish, and tastes rancid. These birds inhabit Europe and North America, and mostly reside at sea, distant from the shore. With us they are seen only in the winter season, when they are plentiful on some parts of the coast of France. They are great divers, and abound in most of the northern regions of the world. They want the horny nail at the end of the bill, which is common to the rest of the genus. As they taste strongly of fish, they are allowed by the Romish church to be eaten in Lent. 327 Nigra.

White fronted or *laughing goose.*—Brown; white, spotted with black beneath; front and rump white; bill and legs flame colour. Breast cinereous; tail dusky, edged with white. Two feet four inches long. Inhabits Europe, Asia, and America. and visits the fenny parts of England, in small flocks in winter. During severe weather it is killed on the coast as well as on rivers, and not uncommonly brought to market and sold for the common wild goose. It leaves us in the earliest spring, none being seen after the middle of March. 328 Albifrons.

B. *Bill equal at the base.*

Scaup duck.—Black; shoulders waved with ash colour; belly and spot on the wings white; bill broad, bluish ash; irides yellow; head and neck greenish black; back and wing coverts waved with black, and cinereous; legs and primary quill-feathers dusky; secondary white, tipt with black; tail coverts, and vent, black. Female brown; bill black, surrounded with a circle of white feathers; neck rusty; belly, and bar on the wings, white; legs black. From 18 to 20 inches long; feeds on shell-fish, and inhabits Europe, northern Asia, and America. It is found in Iceland, Lapland, Sweden, Norway, Russia, and Siberia, and as high as Hudson's bay in America. In England, it appears in the winter season, in small flocks, and is frequently observed in fresh waters. In October it begins to emigrate southward in flocks. It also frequently lives in holes under ground. 329 Marila.

Gray lag goose, or *wild goose.*—Bill semicylindrical; body cinereous above, paler beneath; neck striated; bill flesh-coloured and tipt with white; rump and vent white; legs flesh-coloured; claws black, wants the wing spot. Weighs eight or nine pounds, and is about 33 inches long. Varies much in colour by domestication, in which state it is our common tame goose. Inhabits in flocks the northern parts of Europe, Asia, and America; resides the whole year in the Lincolnshire fens, where it breeds, laying eight or nine eggs which are hatched in 28 or 30 days. Frequents lakes and rivers, and lives to a great age. The domestic goose is well known. It is bred in great multitudes in the fens of Lincolnshire, both on account of its flesh and feathers. The geese are there attended by a person called 330 Anser.

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Anseres. a *gozzard*, who drives them to feed and water. They are plucked five times a year, once for quills and feathers, and four times for feathers only. If the season prove cold, many of them die by this cruel operation. Tame geese have been known to live for 80 years. They generally retain the white rump and vent feathers of their original stock. They feed on water insects, worms, and plants; and by means of two rows of strong sharp teeth within their bills, they crop the herbage in meadows, and do much injury to young corn.

331 *Ruficollis.* *Red-breasted goose.*—Black; white beneath; bill small, conical; neck rufous; spot between the bill and eyes white. Length 21 inches; weight about three pounds. Inhabits Russia and the northern parts of Siberia, but is very rarely found in England. In winter it migrates towards Persia. It is a beautiful species, and its flesh is in high request.

332 *Segetum.* *Bean goose.*—Cinereous; dirty white beneath; bill compressed at the base; tail-coverts white; legs saffron; bill reddish in the middle, black at the base and tip; head and neck inclined to ferruginous; quill-feathers edged with black; tail with white; claws white. Measures from two feet and a half to three feet in length, and weighs from five to seven pounds. Inhabits Hudson's bay and the Hebrides, particularly the isle of Lewis, where it remains all summer and breeds These birds migrate to England in autumn, and leave it again in May, lighting, on their passage, on corn fields, and feeding on the green wheat. In their migration they fly at a great height, sometimes in a straight line, and sometimes in the form of a wedge, cackling as they advance. This species is often killed, and sold for the common wild goose, with which it has been long confounded.

333 *Borealis.* *Garland duck.*—Bill narrow; head green; breast and belly white. Inhabits the fens of Iceland, but is very rare.

334 *Erythropus.* *Bernacle goose.*—Ash-coloured; front white; body waved with black and white above; neck black; belly white; bill short, black, with a flesh-coloured spot on each side, a black spot between the bill and eye; tail white beneath; legs blackish. Twenty-five inches long. Inhabits the north of Europe and Hudson's bay, and appears in large flocks on the north-west coasts of Britain during winter. They are then very wild and shy; but, on being taken, become quite familiar in a few days. In February they quit our shores, and retire as far as Lapland, Greenland, and even Spitzbergen, to breed. In the darker ages this species was seriously believed to be produced from the *lepas anatifera*, a shell which is often found adhering by a pedicle to logs of wood that have lain long in the sea, from which circumstance it obtained the name of *tree-goose* and *clakis*.

335 *Bernicla.* *Brent* or *brand goose.*—Brown; head, neck, and breast, black; collar white; bill, wings, tail and legs, black; broad spot on each side of the neck; tail-coverts and vent white; belly and shoulders cinereous; flanks streaked with white; considerably smaller than the preceding. Inhabits Europe, Asia, and North America. These birds appear on our coasts, particularly in the west of England, during winter, and in Shetland are called *horra geese*. But they are most plentiful in Ireland, where they are taken in nets placed across the rivers, especially in those which empty themselves into the northern parts of the Irish channel. Sometimes they appear in vast flocks on the coast of Picardy, destroying all the corn near the sea. They migrate northward in summer, and return south in autumn, flying high in wedge-shaped flocks. They feed on *polyganum viviparum*, *empetrum nigrum*, and other plants, but chiefly on aquatic plants and marine vermes. They are easily tamed, and reckoned good for the table.

336 *Mollissima.* Plate CCCXCVI. fig. 1. *Eider*, *edder*, or *Cuthbert duck.*—Bill cylindrical; cere wrinkled, and bifid on the hind part; bills, legs, front, ocular band, breast, lower part of the back and belly black; middle of the head, upper part of the back, shoulders, and wing coverts white; a green blotch beneath the hind head. The female almost wholly obscurely ferruginous, with black lines; tail and primary quill-feathers dusky. The young are not mature in plumage till the third, or perhaps the fourth year. This species is nearly double the size of the common duck, and about 22 inches long. It inhabits the high latitudes of Europe, Asia, and America, and feeds chiefly on testaceous animals. It is rarely, if ever, seen in the south of England, but breeds in the north of Scotland, particularly on the Western isles, as also on the Farn islands, on the coast of Northumberland, in June and July. The nest is made on the ground, composed of marine plants, and lined with down of exquisite fineness, which the female plucks from her own body. The eggs are usually five, and of a greenish colour. In Iceland the eider ducks generally build their nests on small islands not far from the shore, and sometimes even near the dwellings of the natives, who treat them with so much attention and kindness as to render them nearly tame. Two females will sometimes lay their eggs in the same nest, in which case they always agree remarkably well. As long as the female is sitting, the male continues on watch near the shore, but as soon as the young are hatched, he leaves them. The mother, however, remains with them a considerable time afterwards; and it is curious to observe her attention in leading them out of the nest almost as soon as they creep from the eggs. Having conducted them to the water's edge, she takes them on her back and swims a few yards with them, when she dives, and leaves them on the surface to take care of themselves. They are seldom afterwards seen on land. When the natives come to the nest, they carefully remove the female, and take away the superfluous down and eggs. They then replace the mother, and she begins to lay afresh, covering the eggs with new down; and when she can afford no more, the male comes to her assistance, and covers the eggs with his down, which is white. When the young ones leave the nest, which is about an hour after they are hatched, it is once more plundered. The best down, and most eggs, are got during the first three weeks of their laying; and it has generally been observed that they lay the greatest number of eggs in rainy weather. One female, during the time of laying, usually yields half a pound of down, which, however, is reduced one half after it is cleaned. When pure, it is sold in Lapland at the rate of two rixdollars a pound. It is extremely soft and warm, and so light and elastic, that a couple of handfuls, squeezed together, are sufficient to fill a covering like a feather bed, which is used in those cold countries instead of a common quilt or blanket. The Iceland company at Copenhagen, generally export every year

Anseres. year from 1500 to 2000 pounds weight of down, cleaned and uncleaned, exclusive of what is privately exported by foreigners. The Greenlanders kill these birds with darts, pursuing them in their little boats, watching their course by the air-bubbles when they dive, and always striking at them when they rise wearied to the surface. Their flesh is valued as food, and their skins are made into warm and comfortable under garments.

337 *Moscata.* *Muscovy duck.*—Face naked, with red caruncles; legs and orbits naked, and with the bill red; tip of the bill and space round the nostrils black; crown black; temples, chin, and throat white, varied with black; breast and lower part of the belly brown, mixed with white; back and rump brown, with a green gold gloss; upper part of the belly white; three first quill feathers white, the rest brown; tail feathers twenty, the outer white, the rest green gold. Two feet long: native of Brazil, and is domesticated in Europe. Has its name, not as vulgarily alleged, from the country of Muscovy, but from the circumstances of its smelling of *musk*, which arises from the liquor secreted in the gland of the rump. Like other domesticated fowls they are subject to great varieties. They are a thriving and prolific species, and not only associate, but sometimes breed with the common duck. Their flesh is much esteemed. Mr Pennant says they are met with wild about Lake Baikal in Asia; Ray, that they are natives of Louisiana; Marcgrave, that they reside in Brazil; and Buffon, that they occur in the overflowed savannas of Guiana, where they feed in the day time on the wild rice, and return in the evening to the sea. He adds, that they nestle on the trunks of rotten trees, and that after the young are hatched, the mother takes them, one after another, by the bill, and throws them into the water. Great numbers of the young brood are said to be destroyed by the alligators.

338 *Clypeata.* *Shoveler.*—Extremity of the bill dilated, rounded, with an incurved nail; bill black; irides yellow; head and neck violet green; breast white, and lunulated; back, wings, and wedged tail brown; belly chesnut; vent white; first and second wing coverts pale blue, greater brown, tipt with white, the rest edged with white; legs tawney. The female has a considerable resemblance to the common duck, but both sexes are very apt to vary in their colourings. This species inhabits Europe, Asia, and North America, but is by no means common in Britain. A few remain in France during the breeding season, making a nest of rushes, in which they lay 10 or 12 rufous-coloured eggs.

339 *Rubens.* *Red-breasted shoveler.*—Brown; chin and breast chesnut; wings tipt with gray, wing-spot purple, edged with white; tail short, white; bill broad, brownish yellow; head large; eyes small; irides yellow; legs small, slender and bay. Size of a tame duck. Sometimes found in the fens of Lincolnshire, but is rare, and little known.

340 *Mersa.* *Ural duck.*—Waved with cinereous and yellowish, and spotted with brown; brown, speckled with gray beneath; throat brown-yellow, waved with black; tail long, black, wedged. Rather bigger than the common teal. Is not unfrequent in the greater lakes of the Ural mountains, and the rivers Oby and Irtisch. Is not seen on the ground, being, from the situation of its legs, unable to walk; but it swims well and quickly, with the tail immersed in the water as far as the rump, and serving as a rudder, contrary to the common method of a duck's swimming. The nest is formed of reeds.

341 *Strepera.* *Gadwall*, or *gray.*—Wing-spot rufous, black, and white; bill flat, black; legs tawney; rump black; back brown, waved with paler; breast and belly gray, varied with white. Nineteen inches long. Inhabits Europe and Northern Asia. Visits Britain in winter, but not in great numbers. Supposed to breed in Sweden, and probably in Russia and Siberia. It is said to be a great diver, and to feed chiefly by night, concealing itself among the reeds and rushes during the day. It makes a noise not unlike that of the mallard, but louder. Its flesh is savoury.

342 *Clangula.* *Golden eye.*—Black and white; head turned; violet; a large white spot at each corner of the mouth; bill black; irides golden; lower part of the neck, breast, and belly, white; back and rump black; legs red. The markings of the female are, head red brown; neck gray; breast and belly white; wing coverts varied with dusky and cinereous; middle quill-feathers white; the rest and tail black; legs dusky. About 19 inches in length. Inhabits Europe, Asia, and North America.

Birds of this species do not assemble in large flocks, nor are they numerous on the British shores or on the lakes in the interior. They are late in taking their departure northward in the spring, and in their flight they make the air whistle with the vigorous quick strokes of their wings. They are excellent divers, and seldom set foot on shore; on which, it is said, they walk with great apparent difficulty, and, except in the breeding season, only repair to it for the purpose of taking their repose. They build in the hollows of trees, and prey on shell-fish, mice, fish, and frogs.

The *anas glaucion*, or *mosillon*, seems to be only a variety of the golden eye in one stage of its plumage, before it arrives at maturity.

343 *Glocitans.* *Bimaculated* or *clucking duck.*—Subcrested; brown, waved with black; head green; a ferruginous spot before and behind the eyes; breast with black spots; wing-spot green, edged with white. Length 20 inches; occurs along the Lena, and about Lake Baikal, and has been taken in a decoy in England. Has a singular note, somewhat like clucking.

344 *Penelope.* *Wigeon, whewer*, or *whim.*—Tail pointed; vent feathers black; head bay; front white; back waved with black and white; bill plumbeous, with a black nail; head and upper part of the neck red, with blackish spots; breast claret; body above waved with cinereous and blackish; wing-spot blue green; black before and behind; wing-coverts varied brown and white; belly white; legs lead colour. Female waved with brown; breast paler. Twenty inches long. Inhabits Europe, Asia, and Africa. Visits England in autumn, when great numbers are taken in decoys, being esteemed an excellent food. It likewise frequents our rivers and salt-water inlets in small flocks. Its is remarkable for uttering a whistling or piping noise, which is frequently heard as it flies during the night. It lives on frogs, worms, insects, and water plants, and is sometimes domesticated. There is a variety with a silvery wing-spot, and the throat waved with ash-colour.

345 *Acuta.* *Pin tail duck.*—Tail pointed, long, black beneath; hind head with a white line on each side; back waved with cinereous; bill black, bluish at the sides; head ferruginous; throat white, a little spotted; body white beneath;

Anseres. neath; wings brown; wing spot violet, ferruginous on the fore part, black and white on the hind part; tail brown, edged with white, two middle feathers longer. Female less; wing-spot straw-coloured, and edged with white. Inhabits Europe, Asia, and America. These birds are seldom numerous in England, but flocks of them are sometimes abundantly spread along the isles and shores of Scotland and Ireland, and on the interior lakes of both these countries. This species measures twenty-eight inches in length, and is esteemed excellent eating.

346 *Ferruginea.* *Ferruginous duck.*—Reddish-brown; bill dilated and rounded at the base; feet pale blue. Weight 20 ounces. Inhabits Denmark and Sweden, but very rarely occurs in this country.

347 *Glacialis.* *Long-tailed duck.*—Tail pointed, long; body black, white beneath; bill black, orange in the middle; head on the fore part and sides reddish-gray; hind-part, breast, and belly, white; scapulars long and white; sides of the neck with a black spot; lower part of the breast, back, wings, and tail, chocolate; four middle tail-feathers black, two middle ones longer, the rest white; legs dusky-red, or blackish. The female has the tail shorter and wedged; the body varied with blackish, rufous, and gray; the back black; collar and lower part of the belly white, Of the size of a wigeon. Inhabits Europe, Asia, and America, frequenting both the interior lakes and the sea shores of these quarters of the world. The birds of this species do not, in the winter, like many of the other tribes, entirely quit their northern haunts, but considerable numbers remain there, enduring the rigours of the season, and enjoying, in summer, the perpetual day of an unsetting sun. Numerous flocks, however, spread themselves southward in the winter, from Greenland and Hudson's bay, as far as New York in America, and from Iceland and Spitzbergen over Lapland, the Russian dominions, Sweden, Norway, and the northern parts of the British isles in Europe. The flocks which visit the Orkney isles appear in October, and continue there till April. About sunset they are seen in large companies going to and returning from the bays, in which they frequently pass the night, making such a noise, as in frosty weather may be heard some miles. They are rather scarce in England, to which they resort only in very hard winters, and even then in small straggling parties. They fly swiftly, but seldom to a great distance, making a loud and singular cry. They are expert divers, and supposed to live chiefly on shell-fish. The female makes her nest among the grass near the water, and, like the eider duck, lines it with the fine down of her own body. According to Latham, she lays five eggs, which are of a bluish white colour, and about the size of those of a pullet.

348 *Ferina.* *Pochard*, or *red-headed wigeon.*—Waved with ash-colour; head brown; pectoral band; vent and rump black; bill broad, blue, tipt with black; irides tawney; head and neck bay; breast and upper part of the back black; scapulars and inner wing-coverts undulated with black and white; belly whitish, with dusky lines at the sides; legs plumbeous. Female darker; head pale reddish-brown; wing-coverts and belly cinereous. Nineteen inches long; weight 28 ounces. Inhabits Europe, Asia and America. This species is frequently caught in the decoys in England, though it is not known to breed there. In some counties it is called *poker*, *dunbird*, or *great-headed wigeon*. It is of a plump round shape, Anseres. walks with a waddling and ungraceful step, but flies rapidly, and in flocks of from 20 to 40, commonly in a compact body. It is much in request for the table, but is not easily domesticated. The male has a labyrinth, or enlargement of the trachea, near the junction with the lungs, a singular conformation peculiar to the male of several species of the duck tribe, but the use of which is still unknown. In winter the pochard migrates southward, as far, it is said, as Egypt.

Garganey.—Wing-spot green; a white line above the eyes; bill lead colour; crown dusky, with oblong streaks; cheeks and neck purple, with white streaks; breast light brown, with semicircular black bars; belly white, lower part and vent speckled; first quill-feathers cinereous, outer webs of the middle ones green; scapulars long, narrow, striped with white, ash colour and black; tail dusky; legs lead-colour. Female, with an obscure white mark over the eye; plumage brownish-ash; wings without the green spot. Length 17 inches. Inhabits Europe and Asia. By some called *pied wigeon*, or *summer teal*. Frequents only the fresh waters, feeding on seeds and aquatic plants. Is not common in Britain, and is said to be impatient of cold. 349 *Querquedula.*

Teal.—Wing-spot green; a white line above and beneath the eyes; bill black; irides hazel; head and neck bright bay; a broad green band behind the eyes to the nape, and terminating beneath in a white line; body whitish, with transverse blackish lines above; fore part of the neck and breast with round black spots; wing-spot green, edged beneath with white, obliquely black above; vent black in the middle. The female is distinguished by the head and neck varied with whitish and brown, and the vent totally white. There are two permanent varieties, of which the first is the wing-spot varying in colour; the body brown-ash above, rufous-white beneath, and black spots on the belly. The second has the cheek, chin, and under parts of the body white-rufous, and the wing-spot without black. Weight about 12 ounces; length 14 inches and a half. The smallest of the duck tribe, and in high request at the table. Inhabits Europe and Asia; visits us in winter, and frequents our fresh waters in small flocks. Many are caught in the decoys, and a few breed in Wolmer Forest, in the morasses about Carlisle, &c. The female makes a large nest composed of soft dried grasses lined with feathers, and cunningly concealed in a hole among the roots of reeds and bulrushes, near the edge of the water. The eggs are of the size of those of a pigeon, from six to ten in number, and of a dull white colour marked with small brownish spots. The male has a bony labyrinth in the lower part of the windpipe. 350 *Crecca.*

Mallard, or *wild duck.*—Cinereous; middle tail feathers (of the male) recurved; bill straight; collar white; bill greenish-yellow; head and neck glossy-green; scapulars white, with waved brown lines; back brown; vent black-green; breast chesnut; belly gray; wing-spot violet-green, edged above with a black and white line; two middle tail feathers dark-green, and recurved. Female reddish-brown, spotted with black. Very subject to vary, especially by domestication, when it is our common tame duck. About 23 inches long. Weight about two pounds and a half. Inhabits Europe, Asia, and America; is very common in marshy places in many 351 *Boschas.*

Anseres. ny parts of this kingdom, but no where occurs in greater plenty than in Lincolnshire, where prodigious numbers are annually taken in the decoys. In only ten decoys in the neighbourhood of Wainfleet, as many as 31,200 have been taken in one season. There is a prohibition, by act of parliament, against taking them between the first of June and the first of October. They do not always build their nest close to the water, but often at a good distance from it, in which case the female will take the young in her beak, or between her legs, to the water. They have sometimes been known to lay their eggs in a high tree, in the deserted nest of a magpie or crow; and an instance has likewise been recorded of one found at Etchingham in Sussex, sitting on nine eggs in an oak, at the height of 25 feet from the ground, the eggs being supported by some small twigs laid crossways. Like many of the tribe, the mallards, in vast numbers quit the north at the end of autumn, and migrating southward, arrive in the beginning of winter in large flocks, and spread themselves over the lakes and marshy wastes of the British isles. They pair in the spring, when the greater number of them again retire northward to breed, but many straggling pairs stay with us; and they, as well as preceding colonists, remain to rear their young, which become natives, and remain with us throughout the year. The common domestic variety of this species assumes very different markings; but the male, even in its tame state, retains the curling of the feathers at the tail. Habits of domestication, however, have deprived the tame duck of that sprightly look and shape which distinguish the mallard, and have substituted a more dull and less elegant form and appearance in their stead. It is also deserving of remark, that ducks pair, and are monogamous in the wild state, but become polygamous when tame. The Chinese make great use of ducks, but prefer the tame to the wild. We are told that most of them in that country are hatched by artificial heat. The eggs being laid in boxes of sand, are placed on a brick hearth, to which is communicated a proper degree of heat during the time required for hatching. The ducklings are fed with cray-fish and crabs, boiled and cut small, and afterwards mixed with boiled rice; and in about a fortnight they are able to shift for themselves. The proprietors then provide them with an old *step-mother*, who leads them where they are to find provender; being first put on board a boat, which is destined for their habitation, and from which the whole flock, amounting often to 300 or 400, go out to feed, and return at command. This method is commonly practised during the nine warmest months of the year, and especially during rice harvest, when the masters of the duck boats row up and down according to the opportunity of procuring food, which is found in plenty at the tide of ebb, as the rice plantations are overflowed at high water. It is curious to observe how these birds obey their masters; for some thousands belonging to different boats will feed at large on the same spot, and on a signal given will follow their leader to their respective boats without a single stranger being found among them. No fewer than 40,000 such boats are supposed to ply on the Tigris. When confined to dry situations, ducks degenerate in strength, beauty, and flavour. They feed on various animal and vegetable substances, for which they unceasingly search with their curiously constructed bills, sifting and separating every alimentary particle from the mud. When older, they also devour worms, spawn, water-insects, and sometimes frogs and small fishes, together with the various seeds of bog and water plants. Anseres.

Black-billed whistling duck.—Brown; head somewhat crested; belly spotted with white and black. Smaller than the preceding. Inhabits Guiana and Jamaica; winters in Carolina, and builds and sits on trees. 352 *Arborea.*

Red-crested duck.—Black; head and upper part of the neck testaceous; crown reddish, that of the male crested; wings beneath, and at the edges white; tail brown. Female brown, and wants the crest. Inhabits the Caspian sea, and the lakes of the Tartarian deserts; is sometimes also found in Italy and Barbary. 353 *Rufina.*

Tufted duck.—Crest pendent; body black; belly and wing-spot white; bill broad, livid, tipt with black; irides golden; head greenish; shoulders blackish-brown, with pale straw-coloured dots; legs dusky-blue. Female brownish, wants the crest. Sixteen inches long. Inhabits Europe and Northern Asia. There are several varieties. It is not uncommon with us in winter, and is frequently seen in our fresh waters as late as near the end of March. It is often brought to market, and sold for wigeon. It lives not only in fresh water, but in the sea; dives well, and feeds on small fishes, crabs and shellfish, and likewise on the seeds of aquatic plants, particularly those of the common rush. 354 *Fuligula.*

Gen. 33. Mergus. 355 Mergus.

Bill toothed, slender, cylindrical, hooked at the point; nostrils small, oval, in the middle of the bill; feet four-toed, outer toe longest. 356 Characters.

The birds of this genus live on fish, and are very destructive in ponds.

Crested merganser.—Crest globular, white on each side; body brown above, white beneath; bill and legs black; irides golden; crest larger than the head, edged with black. Female brown; crest less and ferruginous. Length seventeen inches and a half; weight nearly 23 ounces. An elegant species, which inhabits North America, appearing at Hudson's bay about the end of May, and building, close to the lakes, a nest composed of grass, lined with feathers from its own breast. 357 *Cucullatus.*

Goosander.—A longitudinal crest, somewhat erect; the breast white, without spots; the tail feathers ash-coloured; shaft black; bill, legs, and irides red; greater quill-feathers black; lesser white. Weight about four pounds; length two feet four inches. Inhabits Europe, Asia, and America. Sometimes visits our rivers and lakes in severe winters, but retires to the more northern latitudes to breed. It has been known to build on trees, but more frequently among rocks or stones, and lays 14 eggs, which, with the bird itself, are eagerly devoured by the weasel. It swims with only the head above the surface of the water; dives deep; remains a long time below, and rises at a considerable distance. Its flesh is rancid and scarcely eatable. In quest of fish, it dives with great celerity, and holds its slippery prey with great security by means of its toothed bill, so admirably adapted to the purpose. 358 *Merganser.*

Dun diver, or *sparkling fowl.*—Crested; cinereous; head and upper parts of the neck bay; chin, middle quill feathers, and belly white; bill and irides red; belly sometimes flesh colour. Weighs about 38 ounces; measures 359 *Castor.*

Anseres. measures 25 inches in length. Inhabits the same countries with the preceding, and by some naturalists is reckoned the female; but the labyrinth, or enlargement at the bottom of the windpipe, seems to prove it to be a male, and consequently a distinct species.

360 Serrator. Plate cccxcvi. fig. 2. *Red-breasted merganser.*—Crest pendent; breast reddish and variegated; collar white; tail-feathers brown, varied with cinereous; under part of the bill and legs red; feathers of the sides of the breast large, white, edged with black, covering the fore part of the folded wings. Female with scarcely any crest; head and beginning of the neck rufous. Twenty-one inches long. Inhabits the northern parts of Europe, Asia, and America. Breeds in Greenland, Hudson's bay, Newfoundland, Siberia, the north of Scotland, &c. Makes its nest of withered grass, and down torn from its own breast, on dry land, and lays from eight to 13 white eggs, equal in size to those of a duck.

361 Albellus. *Smew*, or *white nern.*—Crest pendent; hind head black; body white; back and temples black; wings variegated; bill and legs black; wing-spot white; nape, oval spot from the bill surrounding the eyes, back, and two arched lines on each side, near the beginning of the wings, black. Female has the head smooth and gray; band across the eyes black, and under the eyes a white spot; body blackish brown above; white beneath; upper part of the head bay; chin white. From 15 to 17 inches long. Inhabits Europe and America. Breeds in the Arctic regions, and is driven to the south only by severe weather.

362 Minutus. *Minute smew*, or *lough diver.*—Brown ash; under parts of the body and chin white; head and upper part of the neck ferruginous; wing-spot white before and behind. Very much resembles the female of the preceding, but wants the black oval eye-spot. About 14 inches and a half long. Is rarely met with in the south of England, and only in winter when the weather is severe. It dives with great ease in pursuit of fish, and remains long under water.

363 Alca.

Gen. 34. Alca, *Auk.*

364 Characters. Bill toothless, short, compressed, convex, often transversely furrowed: lower mandible gibbous near the base; nostrils linear; legs (in most cases) three-toed.

The birds of this genus are mostly inhabitants of the Arctic seas; are accounted stupid, breed in holes, which they themselves often dig, and in the caverns and fissures of rock, where they rest during the night. In respect of colour, they are generally uniform, being black above, and white beneath. They are shaped like a duck, with their feet placed behind the centre of gravity; their bills are large, having the surfaces crossed with furrows, and ending in an acute point. They lay but one egg, which is very large, considering the size of the bird.

365 Arctica. *Puffin.*—Bill compressed, two-edged with two grooves; orbits and temples white; upper eyelid daggered or furnished with a pointed callus; body black; cheeks, breast, and belly white; bill red, with a black base; legs red. Weighs between 12 and 13 ounces; length upwards of 12 inches. Inhabits the northern seas of Europe, Asia, and America, in vast flocks. Appears on many parts of our rocky coast about the middle of April, and begins to breed about the middle of May. On the Dover cliffs, and other such places, they deposit their single egg in the holes and crevices: in other places they burrow like rabbits, if the soil is light, but more frequently take possession of rabbit burrows, and lay their egg some feet under ground. On St Margaret's island, off St David's, the fishermen put their hands into the holes, and the puffins seize them so obstinately, that they allow themselves to be drawn out. In other places they are caught with ferrets, and the young are taken and pickled. About the latter end of August they retire from our coasts, and have all migrated by the beginning of September. Their principal food is small fish, particularly sprats, with which they feed their young.

Great auk, or *penguin.*—Bill compressed, edged; an oval spot on each side before the eyes. Bill black, with eight or ten grooves; wings short and imperfect; secondary quill feathers tipt with white; legs black. Three feet long. Inhabits Europe and America; occurs in the most northern parts of Britain, and breeds in the isle of St Kilda, appearing about the beginning of May, and retiring about the middle of June. The shortness of its wings renders them useless for flight, but of singular service in diving under water, where they act as fins, and thus enable it to pursue its prey with great velocity. It lays an egg six inches long, white and marked with purple spots, close to the sea mark, being incapable of flying, and almost of walking. 366 Impennis.

Razorbill.—Bill with four grooves, and a white line on each side as far as the eyes. Bill black; the largest groove white; body black above, the under parts, from the middle of the throat, white; secondary quill feathers tipt with white; legs black. In the young bird the bill has but one groove, and, in the still younger, there is no line from the bill to the eyes. Eighteen inches long. Inhabits Europe and North America. The birds of this species associate with the guillemots, and also breed in the same places. About the beginning of May they take possession of the highest impending rocks, for the purpose of incubation, and on the ledges of these rocks they assemble in great numbers, sitting closely together, and often in a series of rows one above another. There they deposit their single large egg on the bare rock, and notwithstanding the multitudes of them which are thus mixed together, yet no confusion takes place; for each bird knows her own egg, and hatches it in that situation. The razorbill is provincially called *auk*, *murre*, *falk*, *marrot*, and *scout*. 367 Torda.

Dusky auk.—Size of the missel thrush; the length 11 inches. Upper mandible of the bill bent at the point; colour yellow brown; the ridge white; irides white, and surrounded with a black circle; forehead covered with downy feathers, which are reflexed, half one way, and half the other: behind the eyes a stripe of white; head and neck black; upper parts of the body black; legs livid; webs black. Inhabits Japan and Kamtschatka. Is sometimes seen at a great distance from land, when it is solitary, but on land is gregarious. 368 Tetracula. Plate cccxcvii. fig. 1.

Perroquet auk.—Bill compressed, with a single groove in each mandible; a white spot on the upper eyelid, between and under the eyes. Inhabits the sea between Japan and Kamtschatka, and often intimates approaching land to mariners. 369 Psittacula.

Tufted auk.—Entirely black; bill with three transverse grooves, 1¼ inch in length, scarlet; sides of the head, 370 Cirrata. Plate cccxcvii. fig. 1.

Anseres. head, space round the eyes, and the angle of the throat, white; a yellow tuft of feathers rises from the upper eyebrow, and stretches to the neck; legs brownish orange; claws black; length 19 inches; female less; the tufts smaller, and the bill crossed only with two grooves. Inhabits Kamtschatka and the neighbouring islands.

371 *Alce.* *Little auk, little black and white diver, Greenland dove, sea turtle*, &c.—Bill without furrows and conical; the whole abdomen and tips of the flag feathers white; feet black. There is a variety that is totally white, and another with a rufous breast. Nine inches long. Inhabits Europe and America, particularly Spitzbergen, Greenland, and Newfoundland, where they are called *ice birds;* but they are rare visitants of the British isles.

372 *Pygmæa.* *Pigmy auk.*—Bill carinated, depressed at the base; body black above, cinereous beneath. Seven inches long. Inhabits the islands between Asia and America.

373 APTENODYTES.

Gen. 35. Aptenodytes, *Penguin.*

374 Characters. Bill straight, a little compressed and sharp-edged; upper mandible longitudinally and obliquely grooved, the lower truncated at the tip; tongue with reflected prickles; wings fin-shaped, without quill feathers; feet placed behind, four-toed, and palmated.

The birds of this genus resemble those of the preceding in colour, food, habit, and apparent stupidity, as also in the situation of their feet, in their erect walk, in their nests, and in their eggs. They differ from them, however, in this, that they are all inhabitants of the South seas, from the equator to the Antarctic circle. They are quite incapable of flying, the feathers on their wings being so short as to resemble scales. They are fortified against cold by an abundance of fat; they swim very swiftly; on land they sit erect, in a singular manner and in vast multitudes, and they cackle like geese, only in a hoarser tone. Their nostrils are linear, and hidden in a furrow of the bill; their wings are covered with a strong dilated membrane, and their tail-feathers very rigid.

375 *Chrysocome.* *Crested penguin.*—Bill reddish brown; legs reddish; frontal crest black, erect, auricular, sulphur colour, and shed on each side; body bluish black, white beneath; wings white beneath. Female with a yellowish stripe on the eyebrow. Twenty-three inches long. Inhabits the Falkland islands, and the southern parts of New Holland. Called *hopping penguin* and *jumping jack*, from its action of leaping quite out of the water, for three or four feet at least, on meeting with the least obstacle. Though more lively than its congeners, it is so foolish as to allow itself to be knocked on the head with a stick, or even to be taken by the hand. When irritated, it erects its crest in a beautiful manner. These birds make their nests among those of the pelican tribe, with which they live in tolerable harmony, and seldom lay more than one egg, which is white, and larger than that of a duck.

376 *Patachonica.* *Patagonian penguin.*—Bill and legs black; ears with a golden spot; lower mandible tawney at the base; irides hazel; head and hind part of the neck brown; back dark blue; breast, belly, and vent white. Four feet three inches long. Inhabits Falkland islands and New Guinea. M. Bougainville caught one, which soon became so tame as to follow and know the person who had the care of it; at first it fed on flesh, fish, and bread, but after some time, grew lean, pined and died. This species is not only the largest, but the fattest of its genus; and its flesh, though not very unpalatable, is black. Anseres.

377 *Demersa.* *Cape penguin.*—Bill and legs black; eyebrows and pectoral band white. Size of a large duck; length 21 inches. Inhabits the Atlantic and Antarctic seas, chiefly round the Cape of Good Hope. Lays two white eggs, which are reckoned delicious eating. Like all of the genus, swims and dives well, but hops and flutters in a strange awkward manner on land, and if hurried stumbles perpetually, or makes use of its wings instead of legs, till it can recover its upright posture, crying at the same time like a goose, but with a hoarser voice. There are two or three varieties.

378 *Minor.* *Little penguin.*—Bill black; legs white. Fifteen inches long. Inhabits New Zealand. Digs deep holes in the earth, in which it lays its eggs.

379 PROCELLARIA.

Gen. 36. Procellaria, *Petrel.*

380 Characters. Bill toothless, a little compressed, hooked at the point; mandibles equal; nostrils cylindrical, tubular, truncated, lying on the base of the bill; feet palmated, hind claw sessile, and without a toe.

The birds of this genus all frequent the deep, where they endure the greatest storms, being hardly ever seen on shore, except at breeding time. They are, however, capable of walking, and their legs are bare of feathers a little above the knee. They feed on the fat of dead whales and fish, and have the faculty of spouting oil from their nostrils.

381 *Pacifica.* *Pacific petrel.*—Black, dusky beneath; legs spotted with black; bill plumbeous and much hooked; nostrils elevated, oval, distinct, obliquely placed; legs pale. Twenty-two inches long. Inhabits, in vast flocks, the islands of the Pacific ocean. These flocks disappear at once, dipping under water altogether, and then rise as suddenly.

382 *Urinatrix.* *Diving petrel.*—Blackish brown; white beneath; bill and chin black; legs blue green, without the spur behind. Eight inches and a half long. Inhabits New Zealand in numerous flocks, and dives remarkably well, often rising at considerable distances, with surprising agility. They croak like frogs, and sometimes make a noise like the cackling of a hen.

383 *Pelagica.* Plate CCCXCVII. fig. 3. *Stormy petrel, stormfinch, Mother Cary's chicken*, &c. —Black, with a white rump. This species is about the size of a swallow, and in its general appearance and flight, not unlike that bird. Length about six inches. The stormy petrel is rarely seen on our shores, except in some of the northern islands, where it breeds in the holes of rocks, or under loose stones, in the months of June and July. At all other seasons it keeps far out at sea. Multitudes of them are seen all over the vast Atlantic ocean, especially before stormy weather. They often skim with incredible velocity along the hollows of the waves, and sometimes on the summits, braving the utmost fury of the tempest. As they appear to run on the surface of the sea, they have their name from an allusion to *Peter's* walking on the water. The inhabitants of the Faroe isles draw a wick through the body of this bird, which is so fat as to burn when lighted, and serve the purpose of a candle.—There is a variety with the

Anseres

the body black; head and sides bluish; scrag green, and wing coverts and rump spotted with green. Both sorts are excellent divers, feed on small fishes, are mute during the day, and clamorous in the night.

384 Nivea. *Snowy petrel.*—Snow white; shafts of the feathers and bill black; legs dusky blue. One foot long. Inhabits the colder parts of the Southern sea, especially in the neighbourhood of ice, the masses of which they often haunt in considerable flocks.

385 Glacialis. *Fulmar petrel*, or *fulmar.*—Whitish; back hoary; bill and legs yellowish; nostrils composed of two tubes, lodged in one sheath. About the size of the common gull, and 17 inches long. Inhabits the Northern and Southern seas; breeds in Greenland, Spitzbergen, St Kilda, &c. laying one large white egg. It is a bold and stupid bird, and very fat, living on fish, dead whales, and other carcases and filth, in quest of which it often follows ships for a great way. Its flesh, though rancid, is eaten raw, dried or boiled, by the Kurile islanders, the Greenlanders and St Kildians, and the oil when expressed is used both for food and lamps. The young are in season about the beginning of August, when the inhabitants of St Kilda endeavour to surprise them in their nests, to prevent them from spouting out their oil, which they do by way of defence. This oil is there valued as a catholicon; and every young bird yields nearly an English pint of it, which is carefully preserved. When the thermometer is above 52 degrees, it is very pure, but at a lower temperature becomes turbid.

386 Gigantea. *Giant petrel, osprey petrel*, or *breakbones.*—Brownish, spotted with white; white beneath; shoulders, wings, and tail brown; bill and legs yellow; a naked, wrinkled, yellow membrane at the angles of the mouth. Bigger than a goose; length 40 inches; expansion of the wings seven feet. Common in the high southern latitudes, and sometimes found, though more rare, in the Northern seas. Is often seen sailing with the wings expanded, close to the surface of the water, but without appearing to move them. At Christmas harbour, Kerguelen's land, &c. they were so tame, that they suffered themselves to be knocked on the head with a stick, by our sailors, on the beach. Though their chief food is fish, they also feed on the carcases of seals and birds. Many of the sailors confound them with the *albatross*, though such of them as are better informed, call them *Mother Cary's geese*. They are reckoned to be very good food. An individual of this species is figured in Latham's Synopsis.

387 Gelida. *Glacial petrel.*—Bluish-ash; back blackish; chin, throat, and breast, white; bill yellow; legs blue. Nineteen inches long. Inhabits the icy seas.

388 Capensis. *Pintado*, or *pintado petrel.*—Variegated with white and brown, and sometimes with yellowish and brown; bill and legs black; temples white and black. Size of the kittiwake; length 14 inches. This is the *pintado bird* of Dampier, the *white and black spotted peteril* of Edwards, and the *Cape pigeon* of our sailors. It is seldom seen much to the north of 30 degrees, and is most frequent about the Cape of Good Hope, and the neighbouring regions. It flies in very numerous flocks, which almost sweep the surface of the water. Our voyagers have traced them to New Zealand, Falkland islands, and various regions of the southern hemisphere. The sailors often catch them with some tarred string, or a bit of lard on a fishing rod. Sometimes they appear in such immense numbers, that 700 have been taken in one night. They feed on fish, but more frequently on the carcases of whales, &c.

Shearwater petrel, or *shearwater.*—Black above; white beneath; legs rufous; bill yellow, tipt with black; hind head whitish-ash; spurious wings spotted with black; first quill and tail feathers brown without and white within. Weight 17 ounces; is 15 inches long, and nearly the size of a pigeon. Inhabits the Southern and Arctic seas. Breeds in the isle of Man, and in the Orkneys, in the former of which it is called *manks puffin*, and in the latter *lyre*. It takes possession of a rabbit burrow or other hole, and lays one white egg, blunt at each end, which is hatched in August. Though the flesh is rank and fishy, it is much relished by some. Great numbers are killed and barrelled with salt. These the inhabitants boil, and eat with potatoes. There is a variety that is cinereous above, white beneath, and with a clear white tail. 389 Puffinus.

Gen. 37. Diomedea, *Albatross*. 390 Diomedea.

Bill straight, upper mandible hooked at the point, lower truncated; nostrils oval, wide, prominent, lateral; tongue very small; toes three, all placed forwards. 391 Characters.

Only four species are known to belong to this genus.

Wandering Albatross, or *man of war bird.*—White; back and wings with white lines; bill pale yellow; legs flesh colour; quill feathers black; tail rounded, and lead coloured; bill grooved, dirty yellow; nostrils remote from the base, and rising out of the furrow; tail feathers fourteen; thighs naked. From three feet and a half to four feet long; bigger than a swan; weighs from twelve to twenty-eight pounds: and extends its wings from ten to thirteen feet. Inhabits most seas, but chiefly occurs within the tropics. It is frequent about the Cape of Good Hope, and towards the end of July appears in great numbers in Kamtschatka, and the seas which separate that part of Asia from America. It is very voracious, feeding on the salmon, which are found in shoals in the mouths of rivers, on the flying-fish, when forced out of the water by the coryphœna, and on other fishes, which it devours whole, and in such quantities, as to be prevented by their weight from rising, though in general it soars very high. It likewise preys on mollusca, and is itself attacked by the sea-eagles, and the larus cataractes. On the shore of South America, it builds about the end of September, a nest of earth on the ground, from one to three feet high, and lays a number of eggs, which are four inches and a half long, and eatable, though the white of them does not coagulate with heat. Its voice resembles the braying of an ass, and its flesh is dry and hard. 392 Exulans. Plate CCCXCVI. fig. 5.

Chocolate albatross.—Bill whitish; body deep chesnut-brown; belly pale; face and wings whitish beneath. Three feet long. Inhabits the Pacific ocean. 393 Spadicea.

Yellow-nosed albatross.—White; bill black; keel of the upper mandible and base of the lower yellow; body above black-blue, white beneath. Three feet long. Occurs in the Southern hemisphere, from 30° to 60°, all round the pole. Flies five or six feet above the water. 394 Chlororhynchos.

Sooty albatross.—Brown; head, bill, tail, quill feathers and claws sooty-brown; area of the eyes white. Three feet long. Inhabits the Southern ocean within the antarctic 395 Fuliginosa.

Anseres. arctic circle. Called *quaker* by the sailors, on account of its brown plumage.

396 Pelecanus.

Gen. 38. Pelecanus, *Pelican*.

397 Characters. Bill straight, bent at the point, and furnished with a nail: the nostrils form an almost obliterated slit; face somewhat naked; legs balancing the body equally; the four toes connected by a membrane.

The pelicans are gregarious, fond of fish, and in general remarkable for their extreme voracity. For the most part they keep out at sea, but some of them are likewise found in the interior parts of continents. They have all a long bill, in a lateral furrow of which lie the nostrils. Several of the tribe are rendered useful to mankind by being taught to fish.

A. *Bill without teeth.*

398 Onocrotalus. *White or common pelican*.—White; gullet pouched; bill from fifteen to sixteen inches long, red; upper mandible depressed and broad, the lower forked; bag at the throat flaccid, membranaceous, capable of great distension; irides hazel; gape of the mouth wide; head naked at the sides, covered with a flesh-coloured skin; hind-head somewhat crested; body faintly tinged with flesh colour; spurious wings and first quill feathers black; legs lead colour. Larger than a swan, and about five feet long. Inhabits Asia, Africa, and South America. In fishing, this bird does not immediately swallow its prey, but fills its bag, and returns to the shore to devour at leisure the fruits of its industry. As it quickly digests its food, it has generally to fish more than once in the course of the day. At night it retires a little way on the shore to rest, with its head resting against its breast. In this attitude it remains almost motionless, till hunger calls it to break off its repose. It then flies from its resting-place, and raising itself thirty or forty feet above the surface of the sea, turns its head, with one eye downwards, and continues to fly in that posture till it sees a fish sufficiently near the surface, when it darts down with astonishing swiftness, seizes it with unerring certainty, and stores it up in its pouch. It then rises again, and continues the same manœuvres, till it has procured a competent stock. Clavigero informs us, that some of the Americans, to procure a supply of fish without any trouble, cruelly break the wing of a live pelican, and after tying the bird to a tree, conceal themselves near the place. The screams of the wounded and confined bird attract others of its kind, which eject for it a portion of provisions from their pouches. As soon as the men observe this, they rush to the spot, and after leaving a small quantity for the bird, carry off the remainder. The female feeds her young with fish macerated for some time in her bag. The pelican is susceptible of domestication, and may even be trained to fish for its master. Faber mentions an individual of this species which was kept in the court of the duke of Bavaria above forty years, and which seemed to be fond of the company of mankind, and of vocal and instrumental music. When a number of pelicans and corvorants are together, they are said to practise a singular method of taking fish. They spread into a large circle, at some distance from land; the pelicans flapping on the surface of the water with their extensive wings, and the corvorants diving beneath, till the fish contained within the circle, are driven before them towards the land; and as the circle contracts by the birds drawing closer together, the fish at last are brought into a small compass, when their pursuers find no difficulty in filling their bellies. In this exercise they are often attended by various species of gulls, which likewise obtain a share of the spoil. The pelican generally builds in marshy and uncultivated places, particularly in islands and lakes, making its nest, which is deep, and a foot and a half in diameter, of carices, and lining it with grass of a softer texture. It lays two or more white eggs, which, when persecuted, it sometimes hides in the water. When it builds in dry and desert places, it brings water to its young in its bag. It walks slowly, flies in flocks, and lives in society with other birds.

Rose-coloured pelican.—Rosy; gullet pouched; bill and legs black; area of the eyes naked; pouch yellow. Size of a goose. Inhabits Manilla. 399 Roseus.

Frigate pelican, or *frigate bird*.—Tail forked; body and orbits black; bill red; belly of the female white. Three feet long; extent of the wings fourteen feet. Inhabits within the tropics. This is the frigate bird of Dampier and other navigators. From its great expanse of wing, it is capable of flying very smoothly, and so high as to be scarcely visible, remaining much in the air, and remote from land. It feeds on fishes, particularly flying fish, on which it darts with the greatest velocity. It not unfrequently likewise preys on other piscivorous animals. It builds in trees or on rocks, and lays one or two eggs of a flesh colour, and spotted with red. 400 Aquilus.

Lesser frigate pelican.—Tail forked; body ferruginous; bill and orbits red. Resembles the last, but less. 401 Minor.

Corvorant.—Tail rounded; body black; head somewhat crested; bill blackish; the base of the lower mandible covered with a yellowish skin, extending under the chin, and forming a pouch; irides green; chin white, surrounded with a yellowish arch; tail long and lax, consisting of fourteen feathers; thighs with a white spot, dotted with black; legs black. Three feet long; size of a goose, but more slender, and weighs about seven pounds. Inhabits Europe, Asia, and America. Common on many of our sea-coasts, building its nest on the highest parts of cliffs that hang over the sea, and laying three or more pale green eggs, about the size of those of a goose. In winter these birds disperse along the shores, and visit the fresh waters, where they commit great depredations among the fish. They are remarkably voracious, and have a very quick digestion. Though naturally extremely shy and wary, they are stupid and easily taken when glutted with food. Their smell, when alive, is more rank and offensive than that of any other bird, and their flesh is so disgusting, that even the Greenlanders will hardly taste it. It is not uncommon to see twenty of these birds together, on the rocks of the sea coast, with extended wings, drying themselves in the wind. In this attitude they sometimes remain for nearly an hour, without once closing their wings; and as soon as the latter are sufficiently dry to enable the feathers to imbibe the oil, they press this liquor from the receptacle on their rumps, and dress the feathers with it. It is only in one particular state that the oily matter can be spread on them, namely, when they are somewhat damp; and the instinct of the birds teaches them the proper moment. Corvorants were formerly 402 Carbo.

sometimes

Anseres. sometimes trained in this country, as they still are in China, for the purpose of catching fish for the table. With this view they were kept with great care in the house, and when taken out for fishing, they had a leathern thong tied round their neck, to prevent them from swallowing their prey.

403 Graculus. *Shag.*—Tail rounded; body black, brown beneath; tail feathers twelve; head and neck black, with a green gloss; back and wing-coverts purple black, glossy at the edges; middle of the belly dusky; legs black. Weighs about four pounds. Length twenty-nine inches. The female weighs about three pounds and a quarter; and is only twenty-seven inches long. Inhabits the northern seas of Europe. Swims with its head erect, and the body under water. On perceiving the flash of a gun, dives instantaneously, and rises at a considerable distance. Has the manners and habit of the preceding, and devours a prodigious quantity of fish. Near the Cape of Good Hope a variety occurs with a yellow chin, and wedged tail. Another, which frequents the coasts of Cayenne and the Carribbee islands, is blackish above, brown beneath; and has the feathers above edged with black.

404 Pygmaeus. *Dwarf shag.*—Tail wedged; feathers twelve; body black, with a few scattered white spots. Female brown, without spots. Size of the garganey. Inhabits the Caspian sea.

405 Cristatus. *Crested shag.*—Shining green, dusky beneath; bill and legs dusky; head crested. From two to three feet long. Inhabits the northern seas of Europe, occurs on our own coasts, and both in appearance and manners, resembles the *graculus*.

B. *Bill serrated.*

406 Thagus. *Saw-billed pelican.*—Brown; tail rounded; gullet pouched, and covered with short cinereous feathers; bill one foot long; each mandible hooked; pouch very large; legs black. Size of a turkey; extent of wings nine feet. Inhabits Chili.

407 Bassanus. *Gannet, or soland goose.*—Tail wedged; body white; bill and quill feathers black; face blue; irides yellowish; tail feathers twelve; eyes surrounded with a naked skin of fine blue; legs black, and greenish on the fore part. Three feet long. Weighs seven pounds; and inhabits Europe and America. This species of pelican haunts the Bass island in the frith of Edinburgh, Ailsa, on the coast of Ayrshire, the island of St Kilda, and hardly any where else in Europe. It arrives at these spots in March, and continues till September. As it must let itself fall before it takes wing, it requires a steep and precipitous breeding station. It makes a rude nest of sticks, grass, sea-plants, &c. and lays one egg. While the female is occupied with incubation, the male brings her food, which consists almost entirely of herrings and sprats. In the bag under their bill they are able to fetch four or five herrings at a time, and a great number of sprats, which the young bird extracts from the mouth of the old one, with its bill, as with pincers. The young begin to be taken in August, and by some are relished as an exquisite morsel; but the old ones are tough and rancid. The fowler who seizes the young, is let down by a rope from the top of a cliff, and is sometimes stationed on the slippery projection of a rock, with the perpendicular precipice of four hundred feet or more beneath him. The young are of a dark gray colour, and continue so for a year or more, when they gradually become white, except the tips of their wings, which are always black. In September and October the old birds leave their breeding places, and migrate southward, following, as is alleged, the shoals of herrings. In December they are often seen off Lisbon plunging for sardines; but after that period it is not well known what becomes of them till March. They are common on the coasts of Norway and Iceland, and are said to be met with in great numbers about New Holland and New Zealand. They also breed on the coast of Newfoundland, and migrate southward along the American shores as far as South Carolina. Of this species there are two varieties. The first is brown, spotted with white, and white beneath, with naked and blackish. The second is brown, with triangular white spots, whitish, and spotted with brown beneath; the bill, wings, tail, and legs brown.

Lesser gannet.—Tail wedged; body whitish; all the quill feathers black; face red. Two feet and a half long. Inhabits the Chinese, Indian, and American seas. 408 Piscator.

Booby.—Tail wedged: body whitish; primary quill feathers tipt with blackish; face red; bill gray, brownish at the base; irides pale ash; chin bald, yellowish; body white beneath; tail brownish at the tip; legs yellowish. Has its name from being so foolish as to alight on one's hand, if held out to it, when tired. Builds in places bare of trees, making its nest on the ground. Its flesh is black and rancid. 409 Sula.

Fishing corvorant.—Tail rounded; body brown, whitish, and spotted with brown beneath; throat white; bill yellow; irides blue. Inhabits China, where it is tamed for the purpose of catching fish. 410 Sinensis.

Lesser booby.—Black, white beneath; face downy. Eighteen inches long. Inhabits Cayenne. 411 Parvus.

Gen. 39. PLOTUS, *Darter.* 412 Plotus.

Bill straight, pointed, toothed; nostrils an oblong slit near the base; face and chin naked; legs short; all the toes connected. 413 Character.

The birds of this genus have a small head, and long slender neck. They inhabit the southern and warmer latitudes, and live chiefly on fish, which they take by darting the head forwards, while the neck is contracted like the body of a serpent.

White-bellied darter.—Head smooth; belly white. Inhabits Brazil. Two feet ten inches long. Builds on trees, and is scarcely ever seen on the ground. When at rest, it sits with the neck drawn in between the shoulders. The flesh is oily and rancid. 414 Anhinga.

Black-bellied darter.—Head smooth; belly black. About three feet long. Inhabits Ceylon, Java, &c. There are several varieties. 415 Melanogaster. Plate CCCXCVI. fig. 4.

Surinam darter.—Head crested; belly white. Thirteen inches long. Inhabits Surinam. Is domesticated, and feeds on fish and insects, especially flies, which it catches with great dexterity. 416 Surinamensis.

Gen. 40. PHAETON, *Tropic Bird.* 417 Phaeton.

Bill sharp-edged, straight, pointed, the gape extending beyond the bill; nostrils oblong; hind-toe turned forwards. 418 Character.

The

Anseres. The species of this genus inhabit the South sea, especially between the tropics. Their bill is compressed and bent a little downwards; the lower mandible angulated. The feet have four toes, which are palmated. The tail is cuneiform, and distinguished by the great length of the two intermediate feathers.

419 *Æthereus.* Plate CCCXCVI. fig. 3. *Common tropic bird.*—White; back, rump, and lesser wing-coverts streaked with white; two middle tail feathers black at the base; bill red. Two feet ten inches long; size of a wigeon. Flies very high, and at a great distance from land; feeds on young sharks, dolphins, and albicores. On land, where it is rarely seen except in the breeding season, it sits on trees, and builds on the ground, in woods. It is well known to navigators, to whom it generally announces their approach to the tropic, though this indication is by no means infallible, as the bird sometimes wanders to the latitude of $47\frac{1}{2}°$. It is subject to varieties. Its flesh is indifferent.

420 *Melanorhynchos.* *Black-billed tropic bird.*—Streaked black and white, white beneath; bill black; quill feathers tipt with white; tail feathers with black. Nineteen inches and a half long. Inhabits Palmerston and Turtle islands.

421 *Phœnicurus.* *Red-tailed tropic bird.*—Rosy flesh colour; bill and two middle tail-feathers red. Two feet ten inches long, of which the two middle tail feathers measure one foot nine inches. Builds in hollows in the ground, under trees, and lays two yellowish-white eggs, with rufous spots. Inhabits the Mauritius.

422 Colymbus.

Gen. 41. Colymbus.

423 Characters. Bill toothless, subulate, straight, and pointed; throat toothed; nostrils linear, at the base of the bill; feet placed far behind.

The birds of this family walk on land with awkwardness and difficulty, but swim and dive with great dexterity. The guillemots chiefly inhabit the sea; have a slender tongue, of the size of the bill. The latter is compressed, and covered with short feathers at the base; the upper mandible a little bent; flesh tough, and, like the eggs, nauseous. The divers frequent also the northern lakes, have a strong bill, less pointed, cylindrical, the edge of the mandible turned in, and the upper longer than the under; the nostrils divided in the middle by a membrane; the tongue long, sharp, serrated at the base on each side; legs slender, a black band between the thighs; tail feathers twenty. These birds are monogamous, fly with difficulty, and frequent fresh water in the breeding season. The grebes have no tail, a strong bill, lores naked, tongue a little cleft at the tip, body depressed, thickly covered with short shining plumage, wings short, and legs compressed. They are frequently found about the fresh waters of southern Europe.

424 Guillemot.

A. Feet three-toed. Guillemot.

425 *Lacteolus.* *White guillemot.*—Snowy; bill and legs brownish and flesh-coloured. Size of the garganey. Inhabits the Netherlands.

426 *Grylle.* *Black guillemot, spotted guillemot, Greenland dove, sea turtle,* &c.—Body black; wing-coverts white. But these general markings are incident to great variety. The more special characteristics are; bill black; inside of the mouth and legs red; upper wing-coverts in the middle, and lower part of the belly, white. Weighs fourteen ounces, and measures nearly the same number of inches in length. Inhabits Europe and America. Frequents the Faroe islands, the Bass, St Kilda, &c. visiting these places in March, making its nest far under ground, and laying one egg of a dirty white, blotched with pale rust colour. Except at breeding time, it keeps always at sea, lives on fish, flies low, and generally in pairs. It cannot, without much difficulty, rise from the ground. In the Orkney islands, it is called *tyste.* The Greenlanders eat its flesh, and use its skin for clothing, and its legs as a bait to their fishing lines.

Lesser guillemot.—Black, with a narrow stripe across the wings, cheeks and under parts white. Weight eighteen or nineteen ounces; length about sixteen inches. Inhabits the northern seas of Europe, and in winter frequents the frith of Forth in vast flocks; where it feeds on sprats, and is called *marrot* or *morrot.* Many doubts have been entertained with regard to this bird, Dr Latham and other ornithologists having considered it as the young of the succeeding species. It is to be observed, however, that besides the difference in size and plumage, this bird is rarely met with in the south till the month of November, whence it has been called the *winter guillemot,* whereas the other species always leaves us before September, and does not again appear till the ensuing spring; and that its young, when they depart, are exactly like the old ones. 427 *Minor.*

Foolish guillemot, or *scout.*—Body black; breast and belly snowy; secondary quill feathers tipt with white; bill black; inside of the mouth yellow; legs and tail blackish. Seventeen inches long. Inhabits the northern seas of Europe, Asia, and America. This species is likewise called *marrot* in Scotland, and *lavie* in St Kilda. In that island it appears about the beginning of February, and is hailed by the inhabitants as the harbinger of plenty. A St Kilda man descends in the night, by the help of a rope, to the ledge of a precipice, where he fixes himself, and tying round him a piece of white linen, awaits the arrival of the bird, which, mistaking the cloth for a piece of the rock, alights on it, and is immediately dispatched. In this way 400 are sometimes taken in one night, and at dawn the fowler is drawn up. The foolish guillemot lays but one egg, which is very large, unprotected by any nest, and has such a slender hold of the rock, that when the birds are surprised, and fly off suddenly, many of them tumble down into the sea. These birds seldom quit their eggs unless disturbed, but are fed with sprats and other small fish by the male. In places where they are seldom molested, it is with difficulty they are put to flight, and may sometimes be taken with the hand; others flutter into the water, appearing not to have much use of their wings. 428 *Troile.*

B. Four-toed, and palmated. Diver. 429 Diver.

Red-throated diver or *loon.*—A ferruginous shield-like spot beneath the neck; body brown, with minute white spots above, white beneath; bill black; head and chin cinereous, spotted with brown; neck with small white and brown lines above; legs dusky. Weighs about three pounds. Length near two feet and a half. Inhabits the north of Europe, Asia, and America, and is seldom seen far southward, except in very severe winters. In the breeding season it frequents the lakes, making a nest among the reeds and flags, and lays two eggs of an ash colour, marked with a few black spots. In Iceland it 430 *Septentrionalis.*

Anseres. it is said to make its nest of moss and grass, lined with down, among the grass of the shores contiguous to the waters. It breeds in the north of Scotland, but is seldom observed in the south of England. It lives on marine vermes, crabs, and the smaller fishes, with which it is sometimes taken in nets. It swims and flies swiftly; and when it screams in its flight is said to presage a storm.

431 Arcticus. *Black-throated diver.*—Head hoary; neck violet black beneath, with an interrupted white band; bill black; body black above, white beneath; sides of the neck white, spotted with black; shoulders and wing-coverts with white spots, the former square, the latter round; quill feathers dusky. Two feet long. Inhabits the northern parts of Europe, Asia, and America, frequenting both the sea and lakes. Before rain, it is restless and clamorous; occurs in Scotland, but is not common in England.

432 Stellatus. *Speckled diver* or *loon.*—White beneath; hind-head and quill feathers dusky; throat pale ash; back, flanks, rump, and tail, spotted with white; bill horn colour; legs brown. The weight of this species is about four pounds, and the length 27 inches. It inhabits the north of Europe and America, and is among the most common of the diver tribe found in this country, being frequently seen in winter, in our bays and inlets, and sometimes in fresh-water rivers and lakes. From its attending the sprats in the Thames, it is called *sprat loon* by the fishermen. In the northern regions it lays two eggs, the size of those of a goose, dusky, and with a few black spots, in the grass, on the borders of lakes.

433 Glacialis. *Northern diver*, or *greatest speckled diver.*—Head and neck purplish black; chin and upper part of the neck with a white interrupted band; upper part of the body, bill, legs, and tail black; back with square white spots disposed in rows; wing-coverts with white dots. The largest of the genus; sometimes weighing fifteen or sixteen pounds, and measuring nearly three feet and a half in length. Inhabits the north seas, and breeds in the fresh waters, in Iceland, Greenland, &c. Frequents the seas about the Orkneys, all the year round, without breeding there. The skin, which is tough, and well covered with soft down, is dressed in some parts of Russia, &c. and used as clothing.

434 Immer. *Immer, imber*, or *ember goose*, or *diver.*—Body blackish and waved with white above, white beneath; feathers of the back, wings, and tail edged with white. Two feet long. Inhabits the Arctic ocean, and also, it is said, the lake of Constance, where it is called *fluder*. Unless in severe winters, it is rare in England, but is more common on the Scottish and Orkney coasts. It makes its nest on the water, among reeds and flags. It feeds on fish, after which it dives with great celerity, and is sometimes taken under water by a baited hook.

435 Grebe.

C. *Feet four-toed, lobed. Grebe.*

436 Cristatus. *Crested grebe, gray* or *ash-coloured loon, &c.*—Head rufous; collar black; secondary quill feathers white; bill flesh-coloured, brown at the tip; lores and irides red; body brown above, white beneath; head tumid, and varies in colour by age. During the first year, this bird has a smooth head, and a white spot on the wings; and during the second, a long downy tuft on each side of the throat. This is the largest of the grebes, weighing about two pounds and a half, and measuring twenty-one inches in length. It occurs in almost every lake in the northern parts of Europe, as far as Iceland, and southward to the Mediterranean, and is also found in various parts of America and Siberia. It is common in the fens and lakes in various parts of England, where it breeds. The female makes her nest of various kinds of dried fibres, stalks and leaves of water plants, as of the nymphæa, potamogeton, hottonia, &c. and the roots of menyanthes trifoliata, and conceals it among the flags and reeds which grow in the water, and where it is erroneously said to float. The young are fed on small eels. In some countries, ladies muffs and other ornamental articles of dress are made of the skin of the belly of this species, which has a fine down of a dazzling whiteness. It requires five skins to make a muff, which sells at four or five guineas. The tippet grebe is the female or young of this species.

Eared grebe, or *dobchick.*—Blackish-brown above, white beneath; head black; ears crested, and ferruginous; bill and legs black; irides and lores red; primary quill feathers dusky, secondary white. There is a smaller variety with a double crest, and the neck spotted with chesnut. This species is about twelve inches long, and inhabits the northern lakes of Europe and Siberia. It is also met with in southern climates, but is not numerous in England. According to Pennant, it breeds in the fens near Spalding in Lincolnshire, and the female makes a nest not unlike that of the preceding, laying four or five small white eggs. 437 Auritus. Plate CCCCVIII. fig. 4.

Horned grebe.—Head glossy-green; a yellow tufted band through the eyes; neck and breast tawney. Size of the preceding. Inhabits North America. 438 Cornutus.

Little grebe, or *small dipper.*—Of a reddish brown above, white, with spots beneath; head smooth; feathers of the body edged with reddish; lower part of the belly gray; upper wing-coverts, and first and last quill feathers blackish, rest of the quill feathers white; bill blackish; base of the lower mandible reddish; legs blackish green. Inhabits Europe, North America, the Philippine isles, and the Delta in Egypt. The least of the grebe tribe, weighing only between six and seven ounces, and measuring from the tip of the bill to the rump, ten inches. It seldom quits the water, and is a remarkable diver, feeding on fish, insects, and aquatic plants; constructing a large nest, a foot thick, of grass and the stalks of aquatic plants, in the midst of the waters which pervade it, and laying five or six whitish eggs, which it covers when it leaves the nest. In several parts of this country it is called *didapper*. 439 Minor.

Red-necked grebe.—Subcrested, brown; chin, cheeks, and region of the ears cinereous; under part of the neck and breast rusty-red; belly, and secondary quill feathers white; bill black, the sides tawney at the base; irides tawney; legs dusky. Seventeen inches long; and weighs nearly nineteen ounces. Inhabits Europe, but is very rare in Britain. 440 Rubricollis.

Dusky grebe, or *black and white dobchick.*—Head smooth; body dark brown above; front, under parts of the body, and tips of the secondary quill feathers, white. Eleven inches long. Inhabits Europe and America. Breeds in the fens of Lincolnshire, and is found, in the winter, in our inlets on the coast, particularly in Devonshire, where it is by no means uncommon. 441 Obscurus.

Black-chin grebe.—Head smooth; body blackish; chin black; throat ferruginous; belly cinereous, mixed with 442 Hebridicus.

Anseres. with silvery. Somewhat larger than the little grebe. Inhabits Tiree, one of the Hebrides.

443 Larus.
Gen. 42. Larus, *Gull*.

444 Characters. Bill straight, sharp edged, a little hooked at the tip, and without teeth; lower mandible gibbous below the point; nostrils linear, broadest on the fore part, and placed in the middle of the bill.

The birds of this genus have a light smooth body; long wings; a strong bill; the tongue somewhat cleft; the feet short; bare of feathers above the knee; with a small back toe. They inhabit the north; feed chiefly on fishes, and even on those that are dead. When harassed, they throw up or discharge their food. As the young are sometimes spotted to their third year, the extrication of this species is attended with doubt and difficulty.

A. *Nostrils without a cere.*

445 *Tridactylus.* *Tarrock*, or *kittiwake*.—Whitish; the back grayish; tips of the tail feathers, except the outermost, black; three toes. In maturer age, the characters are; back whitish hoary; quill feathers white; hind toe unarmed. Ornithologists, in fact, seem now to be agreed, that *L. tridactylus* and *L. rissa*, are only varieties of the same species. A third variety occurs, distinguished by an oblique black band on the wings, and white chin. About the size of a pigeon; about fourteen inches long. Inhabits Europe, Asia, and America. Breeds on the cliffs about Flamborough-head, the Bass, isle of May, the rocks near Slains Castle, &c.; lays two eggs; feeds on fishes, and seeks its food in company of seals and whales. It swims and flies rapidly, and is often clamorous. Its flesh is much relished by the Greenlanders, who also make clothing of its skin. One that was kept and tamed, knew its master's voice at a distance, and answered him with its hoarse piping note. It had a voracious appetite, and though plentifully fed on bread, would rob the poultry of their share.

446 *Minutus.* *Little gull*.—Snowy; head and beginning of the neck black; back and wings russet; bill brown red; legs scarlet. Size of a thrush. Inhabits Russia and Siberia.

447 *Canus.* *Common gull*.—White; back hoary; primary quill feathers black at the ends, the fourth and fifth with a black spot at the tip, the outer one black without; bill yellow; irides hazel; legs greenish white. A variety is met with that has the head spotted with brown; neck brown above, and tail feathers white, with a black band. This is generally supposed to be the younger bird. Inhabits Europe and America. Seventeen inches long; of the size of a pigeon; and is seen in numerous flocks, continually screaming. Lives on fishes, vermes, and the larvæ of insects; builds among rocks and stones, and is a foolish bird. The most common and numerous of all the British gulls, breeding on rocky cliffs, and laying two eggs, nearly the size of those of a common hen, of an olive brown colour, marked with dark-reddish blotches. At the mouths of the larger rivers they are seen in numbers, picking up the animal substances which are cast on shore, or come floating down with the ebbing tide. For this kind of food they watch with a quick eye, and it is curious to observe how such as are near the breakers will mount up the surface of the water, and run splashing towards the summit of the wave to catch the object of their pursuit. At particular seasons, this species also resorts to the inland parts of the country, to feed on worms, &c. Some persons who live near the sea, commonly eat this, as well as various other kinds of gulls, which they describe as being good food, when they have undergone a certain sweetening process before cooking; such as burying them in fresh mould for a day, or washing them in vinegar. This species breeds on the ledges of rocks, close to the sea shore, sometimes not far above the water. This bird is frequently seen in winter, at a considerable distance from the coast. It flocks with rooks in severe weather, and will follow the plough for the sake of the larvæ of the chaffer. 448

Marinus. *Black-backed gull*, or *great black and white gull*.—White; back black; bill yellow; lower mandible with a red spot near the tip and black in the middle; irides yellow; lower part of the back white; quill feathers black, tipt with white; legs flesh-coloured. The markings, however, vary considerably with the age of the bird. The weight of this species is four pounds and three quarters; and the length near thirty inches. It inhabits Europe and America. Though not very plentiful on our coasts, it is occasionally seen in small flocks of eight or ten, sometimes in pairs, but never associating with the other gulls. It cackles like a goose, lives chiefly on fish, but also infests the eider duck, and even lambs. It has been known to tear and devour the largest fish on the hooks, when left dry by the ebbing tide. It breeds on the steep holmes, and Lundy island, in the Bristol channel, makes a nest in the clefts of the highest rocks, and lays three eggs of a blackish gray colour, with dark purple spots, and eatable. Its skin is used for clothing by the Eskimaux and Greenlanders; and the young not only affords a fine down, but an article of food. 449

Herring gull.—White; back brown; legs yellow; *Fuscus.* bill yellow; irides straw-coloured; five first quill feathers black above. Weight about thirty-three ounces. Length twenty-three inches. Inhabits Europe, Asia, and North America, proceeding southward in winter as far as the Black and Caspian seas, Jamaica, and the islands on the shore of South Carolina. It lives on fish, especially herrings, which it seizes with great boldness, and the shoals of which it accompanies in flocks. It is sometimes observed to trample the soft sand, by moving its feet alternately in the same place, for the purpose, it is supposed, of forcing up sand eels, or some hidden prey. This species is very common on the British shores; makes its nest of dry grass on the projecting ledges of the rocks, and lays three eggs of a dull whitish colour, spotted with black. Fishermen describe it as the constant, bold, and intruding attendant on their nets, from which they find it difficult to drive it away. 450

Black-headed gull.—Whitish; head blackish; bill *Atricilla.* red; legs black. Eighteen inches long. Inhabits Europe and America. Flies about the shores in flocks, with a continual clamour; and builds in pine trees. 451

Laughing or *black-headed gull*.—Whitish; head blackish; bill and legs pale red. Eyelids red; irides hazel; *Ridibundus.* head and chin dusky brown; and in the full grown bird black; first ten quill-feathers white-edged, and tipt with black, the rest cinereous, tipt with white; claws black. This species has its name from its singular cry, which resembles a horse laugh. It is fifteen inches long; inhabits Europe, America, and the Bahama islands; and breeds in the pools and fens of England, making its nest on the ground, with rushes, dried grass, &c. and laying three greenish brown eggs, spotted with tawney.

Anseres. tawney. "In former times (says Mr Bewick), these birds were looked upon as valuable property by the owners of some of the fens and marshes in this kingdom, who every autumn caused the little islets or hafts in those wastes, to be cleared of the reeds and rushes, in order properly to prepare the spots for the reception of the old birds in the spring, to which places at that season they regularly returned in great flocks to breed. The young ones were then highly esteemed as excellent eating; and on that account were caught in great numbers before they were able to fly. Six or seven men, equipped for this business, waded through the pools, and with long staves drove them to the land, against nets placed upon the shores of these hafts, where they were easily caught by the hand, and put into pens ready prepared for their reception. The gentry assembled from all parts to see the sport."——"These were the *sea-gulles* of which we read as being so plentifully provided at the great feasts of the ancient nobility and bishops of this realm. Although the flesh of these birds is not now esteemed a dainty, and they are seldom sought after as an article of food, yet in the breeding season, where accommodation and protection are afforded them, they still regularly resort to the same old haunts, which have been occupied by their kind for a long time past."

B. *Nostrils covered with a cere.*

452 *Parasiticus.* *Arctic gull.*—Two middle tail feathers very long; bill and legs dusky; body black above; temples, front, and under parts of the body white; breast with a dusky band. Female brown beneath; twenty-one inches long. Inhabits Europe, Asia, and America. Breeds in the Hebrides and Orkneys, among the heath, making its nest of grass and moss, in some marshy place, and laying two eggs, the size of those of a hen, ash-coloured and spotted with black. It is very rapacious, and pursues the lesser gulls, not for their dung, as some have asserted, but to make them disgorge what they have lately eaten, which it dexterously catches and devours before it reaches the water. It is to be remarked, that all this tribe are voracious, and if chased by a hawk, or other bird that creates alarm, readily disgorge, in order to lighten themselves, and thus escape by flight. It is no uncommon thing to see them bring up a large quantity of half digested food, when slightly wounded by shot; and tamed gulls will do the same, if driven by a dog. It may also be observed, that gulls float highly on the surface of the water by reason of the quantity of feathers in proportion to their weight, and seem to be incapable of diving. If they should be wounded ever so slightly, and fall into the water, they never attempt to dive like other aquatic birds.

453 *Crepidatus.* *Black-toed gull.*—Varied with dirty white and brown, paler beneath; two middle tail feathers a little longer; bill black; breast and belly white, with numerous dusky and yellowish lines; flanks and vent transversely black and white; wing-coverts and tail black, edged with white or brownish; legs bluish; toes and connecting membrane black. Weight about eleven ounces; length fifteen or sixteen inches. Inhabits Europe and America, but is not common on the British shores. Its habits nearly coincide with those of the preceding species. Its excrement is said to be red, from the circumstance of its feeding on the *helix janthina*.

454 *Catarractes.* *Skua gull.*—Grayish; quill and tail feathers white at the base; tail nearly equal; bill dusky, much hooked, upper mandible covered half way with a black cere; body brown above, rusty-ash beneath; legs blackish, rough, warty; claws hooked, black; hind-toe short, with a sharp-hooked claw; two feet long. Inhabits Europe and America. These fierce birds are met with by navigators in the high latitudes of both hemispheres, where they are much more common than in the warm or temperate parts of the globe. They are often mentioned in Captain Cook's Voyages, and, from their being numerous about Falkland islands, the seamen call them *Port Egmont hens*. They are also common in Norway, Iceland, the Shetland and Faroe isles, &c. They prey not only on fish, but also on the lesser sorts of water fowl, and are so courageous in defence of their own young, that they attack either man or beast, that dares to disturb their nest. They make their nests among the dry grass, and, when the young are reared, they disperse themselves commonly in pairs over the ocean. In the island of Foula, in Shetland, the skua gull is called *bonxie*, and is a privileged bird, there being a fine of 10l. Scotch for destroying its eggs, because it keeps off the eagle during the whole breeding season.

Gen. 43. STERNA, *Tern.* 455 Sterna.

Bill subulate, somewhat straight, pointed, a little compressed, without teeth; nostrils linear; tongue pointed; wings very long; tail generally forked. 456 Characters.

The birds of this genus are mostly inhabitants of the ocean, and feed on fishes. They are seldom afraid of man.

Sooty tern.—Black above; upper parts of the body, cheeks, front and shafts of the quill and tail feathers white; sixteen inches long. Inhabits the Atlantic and Antarctic seas. 457 Fuliginosa.

Noddy.—Body black; front whitish; eye-brows black; bill and legs black; hind-head cinereous; fifteen inches long; found chiefly within the tropics; is clamorous, seldom goes far from shore, and always rests there during the night. It builds on the rocks, and its eggs are reckoned excellent food. 458 Stolida.

Sandwich tern.—White; back and wings hoary; cap black; front with white spots; quill feathers blackish, with a white shaft; bill black, yellowish at the tip; legs black; wings longer than the tail; egg olive-brown, with purplish and crowded spots; eighteen inches long. Inhabits the Kentish coast, generally appearing about Romney, in the middle of April, and departing in the beginning of September. It is not uncommon about Sandwich, where it was first particularly noticed by Mr Boys. The circumstance of its breeding in England has not been perfectly ascertained. The *hævia* of some authors, or the *Kamtschatkan tern* of Pennant, appears to be only a variety, which is black, with paler colours above; white beneath; and bill and legs black. 459 Cantiaca.

Common or *greater tern.*—Two outer tail feathers half black, and half white; bill and legs crimson; the former tipt with black; crown and area of the eyes black; rest of the head, neck, tail, and body, white beneath; back and wings cinereous; outer tail feathers black on the outer edge. There is a variety with black legs, and the outer tail feathers entirely white. The weight of this species is about four ounces and a quarter; and 460 Hirundo.

Anseres. and its length fourteen inches. Inhabits Europe, Asia, and America. It frequents our flat, sandy, or shingly shores, and lays three or four eggs, of the size of a pigeon's, of an olivacious brown, and spotted and blotched with dusky, among stones, without making any nest. It is noisy and restless, constantly on wing, in search of insects and small fish; in pursuit of which it darts into the water with great force, seizes its prey, and instantly returns; for, though web-footed, it is not observed to swim or dive. It is commonly known by the name of the *sea-swallow*, and, in some parts, by that of the *gull teaser*, from its persecuting the smaller gulls, and obliging them to disgorge. In New England it is called *mackarel gull*, and at Hudson's bay it is known by the name of *black-head*. The young birds are mottled with brown and white, and are, most probably, the *brown tern* described by Ray and other ornithologists.

461 Alba. *White tern.*—White; bill and legs black; length between two and three inches. Inhabits the Cape of Good Hope.

462 Nigra. *Black-headed tern.*—Body hoary; head and bill black; legs red; size of the preceding. Inhabits Europe.

463 Minuta. Plate CCCXCVII. fig. 5. *Lesser tern.*—Body white; back hoary; front and eye-brows white; bill yellow, tipt with black; irides brown; cap black; a black band through the eyes; legs yellow; eight inches and a half long. Inhabits Europe and America. It has the habits of the common species, but is far less numerous. It lays two eggs, of a very pale brown, spotted all over with cinereous and dusky, and placed in a small depression among the shingle, without any nest.

464 Fissipes. *Black tern.*—Body black; back ash-coloured; belly white; feet red; bill black; male with a white spot on the chin; wings and tail cinereous; vent and lower tail coverts white; length ten inches. Inhabits Europe and America, and has all the actions and manners of the other species, but seems to prefer fresh-water insects and fish to marine. It feeds on the verge of pools, in swampy places, and often remote from the sea. In the fenny parts of Lincolnshire and Cambridgeshire it is called *car-swallow*. Though very plentiful about the reedy pools of the Romney marshes, it keeps to the edges of the stagnant water, and is rarely seen on the adjoining sea shore, till after the breeding season, and even then not very commonly. It lays three or four eggs about the size of those of a magpie, of an olive brown colour, blotched and spotted with brown and black.

465 Rynchops.

Gen. 44. Rynchops, *Skimmer*.

466 Characters. Bill straight; upper mandible shorter than the under, the latter truncated at the apex; tail forked and shorter than the wings; nostrils linear, and the back toe small.

467 Nigra. *Black skimmer*, or *cut-water*.—Blackish; white beneath; bill red at the base; the lower mandible grooved; front and chin white; wings with a transverse white band; two middle tail feathers black, the next edged with white; legs red; twenty inches long. Inhabits Asia and America. This bird is ever on the wing, sweeping the surface of the water, dipping in its bill, or at least the under mandible, to scoop out the smaller fishes on which it feeds. In stormy weather it frequents the shores, and is contented with oysters and other shell-fish.

Grallæ.

Order IV. GRALLÆ.

468 Grallæ.

Bill subcylindrical, and somewhat obtuse; tongue entire and fleshy; legs naked above the knees; the feet are commonly furnished with four toes, of which three stand forwards, and one backwards, sometimes wholly unconnected, and at other times half connected by a web. Some species, too, have only three toes; their legs are long, that they may seek their food in marshy and swampy places, for which reason they have also a long neck, and, for the most part, a long bill. Their bodies are oval, and somewhat compressed, and their tail is generally short. They build chiefly on the ground and in marshy places, and feed principally on fishes and water insects. They are all more or less migratory, and such as inhabit the more northern countries of Europe, universally leave them at the approach of winter. 469 Characters.

Gen. 45. Phænicopteros, *Flamingo*. 470 Phænicopteros.

Bill bare, toothed and bent as if broken; nostrils linear; the feet four-toed and palmated, the membranes semicircular on the fore part; hind toe not connected. 471 Characters.

The birds of this genus combine the anseres with the grallæ. They have the neck and legs long; the bill strong and thick, the upper mandible carinated above, and denticulated at the margin, the under one compressed and transversely sulcated; the nostrils above covered with a thin membrane, and communicating with each other; the back-toe very small, and the web which connects the fore-toes reaching to the nails.

Red flamingo.—Flag feather black. This singular bird is scarcely so big as a goose, but has the neck and legs in a greater disproportion to the body than any other bird; the length from the end of the bill to that of the tail being four feet and two or three inches; but to the end of the claws, sometimes more than six feet; the bill is four inches and a quarter long, and of a structure different from that of any other bird, the upper mandible being very thin and flat, and somewhat moveable, the under thick, and both bending downwards from the middle; the end, as far as the curvature, is black, and the rest reddish-yellow; a flesh coloured cere extends round the base of the bill to the eye; the neck is slender and of an immoderate length; the tongue, which is large and fleshy, fills the cavity of the bill, has a sharp cartilaginous tip, and is furnished with twelve or more hooked papillæ on each side, which bend backwards. The bird, when in full plumage, which it does not acquire till the third year, is of a most beautiful deep scarlet, except the quills, which are black. The flamingo affects the warmer latitudes; and, in the old continent, is not often met with beyond the 40th degree north or south. It is met with every where on the African coast and adjacent isles to the Cape of Good Hope, and sometimes on the coast of Spain and Italy, and even on those of France that lie on the Mediterranean, having been found at Marseilles and for some way up the Rhone. It is seen also on the Persian side of the Caspian sea, and from thence along the western coast as far as the Wolga. They breed in the Cape de Verd isles, particularly in that of Sal, constructing a nest 472 Ruber. Plate CCCXCVIII. fig. 1.

 of

of mud in the shape of a hillock, with a cavity at top, in which the female generally lays two white eggs, of the size of those of a goose, but more elongated. The hillock is of a sufficient height to admit the bird's sitting on it conveniently, or rather standing, as the legs are placed one on each side at full length. Sometimes the female will deposit her eggs on the projecting part of a low rock, if otherwise adapted to the above-mentioned attitude. The young are not able to fly till they are grown, but they can previously run with amazing swiftness. In this immature state, they are sometimes caught and easily tamed. In five or six days, they became familiar, and even eat out of the hand, and drink a great quantity of sea water. It is, however, difficult to rear them, as they are very liable to pine from want of their natural subsistence, which chiefly consists of small fish and water insects. These they take by plunging the bill and part of the head into the water, and from time to time trampling the bottom with their feet, to disturb the mud, and raise up their prey. In feeding they are said to twist the neck in such a manner, that the upper part of their bill is applied to the ground. Except in the breeding season, flamingos are generally observed in great flocks, and at a distance appear like a regiment of soldiers, being often ranged alongside of one another on the borders of rivers. When the Europeans first visited America, they found these birds on the shores tame and gentle, and no way distrustful of mankind. We learn from Catesby, that when the fowler had killed one, the rest of the flock, instead of attempting to fly, only regarded the fall of their companion in a kind of fixed astonishment; so that the whole flock were sometimes killed in detail, without one of them attempting to make its escape. They are now, however, extremely shy, and one of their number acts as sentinel, while the rest are feeding. The moment that this guard perceives the least danger, he gives a loud scream, like the sound of a trumpet, and instantly all are on the wing, and fill the air with their screams. The flamingo, when at rest, stands on one leg, the other being drawn up to the body, with the head placed under the wing on that side of the body on which it stands. Its flesh is esteemed tolerable eating, and that of the young has been compared to partridge. Pliny, Martial, and other writers of antiquity, have celebrated the tongue as a morsel of exquisite relish.

473 *Chilensis.* *Chili flamingo.*—Quill feathers white; bill covered with a reddish skin; head subcrested; measures five feet from the bill to the claws. Inhabits Chili; frequents only fresh waters, and is extremely shy.

474 PLATALEA.

Gen. 46. PLATALEA, *Spoonbill.*

475 Characters. Bill long and thin, the tip dilated, orbicular and flat; nostrils small at the base of the bill; tongue short and pointed; feet four-toed and semipalmated.

476 *Leucorodia.* *White spoonbill.*—Body white; chin black; hind head somewhat crested. Bill black, brown or spotted; tongue heart-shaped; irides gray; lores, orbits, and naked dilatable chin, black; quill feathers sometimes tipt with black; legs black. This species admits of two varieties, of which the first has the wings varied with black and white, and the legs yellowish; and the second has the body all white, and the legs flesh coloured. The white or common spoonbill weighs about three pounds and a half, and measures two feet eight inches in length. It inhabits from the Feroe isles to the Cape of Good Hope; but rarely occurs in England. It lives on grass, carices, the roots of reeds, serpents, frogs, muscles, and other shell-fish, but especially on fishes, which it often seizes from other birds. It makes its nest in high trees, near to the sea, and lays three or four white eggs, sprinkled with a few pale red spots. The flesh, especially of the young bird, tastes like that of goose.

Roseate spoonbill.—Body rose-coloured; tail coverts scarlet; bill cinereous white, with a furrow parallel with the edges; face and chin naked and whitish; legs gray. This species also frequently appears of a blood red hue; the neck white; collar black; and tail feathers scarlet. Two feet three inches long. Inhabits South America and Jamaica. Figured in Latham's Synopsis. 477 *Ajaja.*

Dwarf spoonbill.—Body brown above; white beneath. Size of a sparrow. Inhabits Guiana and Surinam. 478 *Pygmæa.*

Gen. 47. PALAMEDEA, *Screamer.* 479 PALAMEDEA.

Bill conical, the upper mandible hooked; nostrils oval; feet four-toed, cleft, a very small membrane connecting the toes at the root. 480 Characters.

Horned screamer.—Wings with two spines at the curvature, front horned; bill and legs black; irides golden; body blackish above, white beneath; wings reddish beneath; spine strong, sharp, horny, triangular, yellow; horn on the front recurved, round, whitish, three inches long; hind toe straight. Three feet four inches long. Inhabits the fenny parts of South America; making a large nest of mud, in the shape of an oven, on the ground, and laying two eggs the size of those of a goose. It is remarked, that they are always met with in pairs, and if one dies, the other mourns to death for the loss. On hearing the least noise, or seeing any one, even at a distance, they rise from the ground and make a loud screaming noise. They feed principally on herbs, seeds, and reptiles The flesh of the old bird is tough and ill tasted; but that of the young, though very dark, is frequently eaten by the natives. 481 *Cornuta.*

Crested screamer.—Wings unarmed; front crested. Size of a heron. Inhabits Brazil. 482 *Cristata.*

Gen. 48. MYCTERIA, *Jabiru.* 483 MYCTERIA.

Bill a little bending upwards and sharp-pointed; upper mandible triangular; front bald; nostrils linear; tongue small or wanting; four-toed and cleft. 484 Characters.

American jabiru.—White; quill and tail feathers purplish-black; bill long, stout and black; head and neck bald, two-thirds of the neck blackish, the rest red; hind head cinereous; legs long, stout and blackish. Nearly six feet long. Inhabits the savannas of South America; is migratory and gregarious, makes its nest in large trees, lays two eggs, and tends the young till they can descend to the ground. The colour of the young birds is gray; the second year it changes to rose colour, and the third to pure white. They are very wild and voracious, and destroy great quantities of fish. The flesh of the young birds is said to be good eating, but that of the old is hard and oily. 485 *Americana.*

Indian jabiru.—White; band over the eyes, lower part of the back, quill and tail feathers, black; bill blackish; 486 *Asiatica.*

Grallæ. blackish; upper mandible gibbous at the base; lower tumid beneath; legs flesh-coloured. Inhabits India, and feeds on shell-fish.

487 *Novæ Hollandiæ.* *New Holland jabiru.*—Body purplish-green above, under parts, neck and shoulders white; head purplish, spotted with white; neck feathered; irides yellow; first quill feathers white; tail black and white. Full six feet long; is supposed to live chiefly on fish. Inhabits New Holland. Figured in Latham's Supplement.

488 CANCROMA.

Gen. 49. CANCROMA, *Boatbill.*

489 Characters. Bill gibbous, and shaped like an inverted boat; nostrils small, and placed in a furrow; tongue small; toes divided.

490 *Cochlearia.* *Crested boatbill.*—Crested; cinereous; belly rufous; crown and lunule on the neck black; bill brown; lores naked and blackish; crest long, pendulous and pointed; legs yellowish-brown; toes connected at the base. The body is sometimes spotted with brown. Twenty-two inches long. Inhabits South America; perches on trees which overhang the water, and darts down on the fish as they swim underneath. It likewise feeds on crabs.

491 SCOPUS.

Gen. 50. SCOPUS, *Umbre.*

492 Characters. Bill thick, compressed, long and straight; nostrils linear and oblique; feet with four unconnected toes.

493 *Umbretta.* Plate CCCXCVIII. fig. 4. *Tufted umbre.*—With a crest; bill brown, with a longitudinal furrow on each side, in which are placed the nostrils: lower mandible narrower towards the end, and a little truncated; crest thick, tufted and lax; body brown; tail obscurely barred; legs longish and brown. Female not crested. Twenty inches long. Inhabits Africa.

494 ARDEA.

Gen. 51. ARDEA.

495 Characters. Bill straight, pointed, long, somewhat compressed, with a furrow from the nostrils towards the tip; nostrils linear; tongue sharp; feet four-toed, cleft; toes connected at the base.

The birds of this numerous genus have long feet and necks, and live on amphibious animals and fishes.

A. *Crested, and bill scarcely longer than the head.*

496 *Pavonia.* *Crowned heron*, or *crown bird.*—Crest bristly and erect; temples with two naked wattles; bill brownish; irides gray; crown covered with short silky feathers; crest circular, yellowish, tipt with black; temples and wattles red; body bluish ash; wing-coverts white, the greater ones reddish, those next the body blackish; tail and greater quill feathers black, the secondary bay; legs dusky. The female is black, where the male is bluish-ash, has no wattles on the throat, and the long feathers on the breast less conspicuous. This beautiful species, the *balearic crane* of Ray, and the *crowned African crane* of Edwards, is two feet nine inches long; and inhabits Africa, particularly the coast of Guinea, as far as the Cape de Verd islands. At the latter it is said to be very tame, and so familiar as to come into the court-yards to feed with the poultry. It is supposed to feed chiefly on worms and vegetables, often sleeps on one leg, runs very fast, and not only flies well, but continues on wing for a long time together. The flesh is said to be very tough.

497 *Virgo.* *Demoiselle heron, demoiselle of Numidia*, or *Numidian crane.*—A tuft of long, white, pendant feathers behind each eye; bill yellowish; the base greenish, tip red; irides red; head and tips of the primary quill feathers black; feathers of the breast long and pendulous; crest over the eyes turned back, and pendulous; body bluish-ash; crown cinereous; head, neck, throat, breast and legs black. The wind-pipe does not, as in the generality of birds, go straight forwards into the lungs, but first enters a cavity in the keel of the breast bone, for about three inches, when it returns, after making a bend forwards, and then passes into the chest. This elegant species is about the size of the common crane; and three feet three inches long. It is found in many parts of Africa and Asia, but most plentifully about *Bildulgerid*, the ancient Numidia, and Tripoli. It also occurs at Aleppo, and in the southern plain, about the Black and Caspian seas, and not unfrequently beyond Lake Baikal, about the rivers Selenga and Argun, but never ventures to the northward. It affects marshes and rivers, subsisting chiefly on fish. In the Crimea it builds its nest in open plains, generally in the vicinity of the salt lakes. The young birds are brought to market by the Tartars, and are so susceptible of domestication, that they even afterwards breed in the farm-yards. From the gentleness of its manners and the elegance of its form, it is often kept in menageries. In confinement, it often assumes strange and uncouth attitudes, and seems occasionally to imitate dancing; and Keysler mentions one in the gallery at Florence, which had been taught to dance to a certain tune, when played or sung to it.

B. *Cranes; head bald.* 498 *Cranes.*

Common crane.—Hind head naked and papillous; cap and quill-feathers black; body cinereous; innermost tail feathers jagged; bill greenish-black; front covered with black down; hind head red, with a few scattered hairs, and a cinereous area beneath; temples and upper neck white; legs black. There is a variety with the body white; and the lower part of the neck and quill feathers black; bill greenish black; front covered with black down; hind head red, with a few scattered hairs, and a cinereous area beneath; temples and upper neck white; legs black. Weighs near 10 pounds; length five feet. Inhabits Europe and Asia, and annually migrates in flocks to the southern parts of Asia and Africa, in autumn. The course of their flight is discovered by the loud noise which they make; for they soar to such a height as to be scarcely visible to the naked eye. Like the wild geese, they form themselves into different figures, describing a wedge, a triangle, or a circle. It is said that formerly they visited the fens and marshes of England, in great numbers; but they seem now, in a great measure, to have forsaken our island. They are seen in France in the spring and autumn; but generally only as passengers. They make their nests in marshes, and lay two bluish eggs. They feed on reptiles of all kinds, and on several sorts of vegetables, particularly green corn; among which, if a flock alights, it makes great havock. Like other large birds, the crane has much difficulty in commencing its flight. 499 *Grus.*

Siberian crane.—White; temples and front naked, red, wrinkled; ten first quill feathers shining black; bill and legs red. Stands four feet and a half high. Inhabits the marshy flats of Siberia, and feeds on reptiles, worms, and small fish. 500 *Gigantea.*

C. *Storks;*

C. *Storks; orbits naked.*

501 Storks. 502 Ciconia. *White stork.*—White; orbits and quill feathers black; bill, legs and skin red; greater wing coverts black. Inhabits Europe, Asia, and Africa. Is about the size of a turkey; and measures three feet three inches in length. Feeds on fish and reptiles, and in several countries is protected for its use in destroying serpents. Vast numbers annually resort to some parts of Holland, and even as far north as Russia, to breed, but rarely visit England. They observe great exactness in the time of their autumnal departure from Europe to more favoured climes. They pass a second summer in Egypt, and the marshes of Barbary; pairing in the former country, and rearing a second brood. Before each of their migrations, they rendezvous in amazing numbers, and are for a while much in motion among themselves, till, after making several short excursions, as if to try their wings, they all on a sudden take flight with great silence, and with such speed, as in a moment to be out of sight. At Bagdad, hundreds of their nests are to be seen about the houses, walls, and trees; and at Persepolis, the remains of the pillars serve them to build on, every pillar having a nest on it. Shaw mentions flights of them leaving Egypt, and passing over Mount Carmel, each half a mile in breadth. The good-natured Hollanders provide boxes for them to build their nests in, on the tops of their houses, and resent any injury done to the birds as an offence committed against themselves. The stork is of a mild and affectionate disposition; and though it has a grave air, yet, when roused by example, is not averse from gaiety. "I saw", says Dr Hermann, "in a garden where children were playing at hide and seek, a tame stork join the party, run its turn when touched, and distinguish the child whose turn it was to pursue the rest, so well, as, along with the others, to be on its guard."—To this bird the ancients ascribed many of the moral virtues, as temperance, vigilance, conjugal fidelity, and filial and parental piety.

503 Nigra. *Black stork.*—Brown; breast and belly white. Two feet nine inches long. Inhabits Europe and Asia. Feeds on fish and reptiles; is timid, and retires into thick woods and inaccessible fens.

504 Herons. D. *Herons; middle claw inwardly serrated.*

505 Dubia. *Gigantic heron.*—Glaucous above; dirty white beneath; bill a little triangular. This is a large species, measuring from tip to tip of the wings, nearly 15 feet. The bill is of an enormous size, and 16 inches round at the base. The head and neck are naked, except a few straggling curled hairs. The feathers of the back and wings are of a bluish ash colour, and very stout; those of the breast long. The craw hangs down the fore part of the neck, like a pouch, thinly covered with down. The belly is covered with a dirty white down, and the upper part of the back and shoulders surrounded with the same. The legs and about half of the thighs are naked, and the naked parts are full three feet in length. The gigantic heron inhabits Bengal, and is sometimes found on the coast of Guinea. It arrives in the interior parts of Bengal before the period of the rains, and retires as soon as the dry season commences. Though its aspect is far from inviting, it is one of the most useful birds of these countries, in clearing them of snakes and noxious reptiles and insects. They sometimes feed on fish; and one of them will generally devour as much as would serve four men. On opening the body of an individual of this species, a land tortoise, 10 inches long, and a large black cat, were found entire within it, the former in the pouch and the latter in its stomach. Being, undaunted at the sight of mankind, they are soon rendered familiar; and when fish or other food is thrown to them they catch it very nimbly, and immediately swallow it entire. A young bird of this kind, about five feet in height, was brought up tame, and presented to the chief of the Bananas, where Mr Smeathman lived. It regularly attended the hall at dinner time, placing itself behind its master's chair, frequently before any of the guests entered. The servants were obliged to watch it carefully, and to defend the provisions by beating it off with sticks: yet notwithstanding every precaution, it would frequently snatch off something from the table, and one day purloined a whole boiled fowl, which it swallowed in an instant. It used to fly about the island, and roost very high among the silk cotton trees; from this station, at the distance of two or three miles, it could see when the dinner was carried across the court; when darting down, it would arrive early enough to enter with some of those who carried in the dishes. When sitting, it was observed always to rest itself on the whole length of the hind part of the leg. Sometimes it would stand in the room for half an hour after dinner, turning its head alternately as if listening to the conversation. These birds are found in companies, and when seen at a distance, near the mouths of rivers, advancing towards an observer, it is said that they may be easily mistaken for canoes on the surface of a smooth sea, and when on the sand banks, for men and women picking up shell-fish on the beach.—From their immense gape, they have obtained the name of *large throats*, and from their swallowing bones, that of *bone eaters* or *bone takers*. 506

Night heron.—Crest on the hind head white, horizontal, of three feathers; back black; belly yellowish. Nycticorax. The female has the head smooth and brown; belly brownish and white beneath; and the first quill feathers with a white spot at the tip. About 20 inches long. Inhabits Europe, Asia, and America. Only one instance occurs of its having been met with in England. It is pretty common in Russia, particularly on the Don, where it builds in trees, and is also met with at Astracan during summer. It is said to lay three or four white eggs, and sometimes to build among the rocks. It has a very uncouth and rough voice, like that of a person straining to vomit. 507

Crested purple heron.—Hind head black; crest pendent, and composed of two long feathers; body olive above, purplish beneath. Two feet 10 inches long. Inhabits Asia. 508 Purpurea.

African heron.—Crested; body cinereous; neck, breast and belly, ferruginous; chin white; neck with three black lines; bill and legs yellow; crest of three long feathers; feathers of the breast and rump mixed with ferruginous; a broad black line from the nape to the back, and another on each of the sides. About three feet long; and smaller than the common heron. Inhabits Asia and Africa, and has been twice found in England. 509 Caspica.

Common heron.—Hind head with a pendent crest; Major. body ash coloured; line on the neck beneath and pectoral bar black. The female has the hind head smooth and black; back bluish and whitish beneath; and the breast

Grallæ

breast with oblong black spots. Bill dusky; base yellowish beneath; area of the eyes naked and greenish; irides yellow; temples black; front, crown, and neck, white above; spurious wings and greater quill feathers black; scapulars and feathers of the throat long, lax, and narrow; body white beneath; legs dirty green. The weight of this species is about three pounds and a half; and the length about three feet four inches. Inhabits almost every where in fenny places, and is common in England. It is a great destroyer both of sea and fresh water fish, being enabled, by the great length of its legs, to wade into some depth of water, where it stands motionless, till some of the finny tribe approach, when it darts its bill into them in an instant. Its digestion being as quick as its appetite is voracious, it commits great devastation in ponds and shallow waters. It will likewise eat frogs and vegetables. They are frequently observed to feed by moon light, when the fish come into the shoaler waters. In the breeding season, herons are gregarious, and make their nests very near one another. Pennant mentions having seen eighty nests on one tree, and Mr Montagu once saw a heronry on a small island in a lake, in the north of Scotland, on which there was but a single scrubby oak, which not being sufficient to contain all the nests, many were placed on the ground. The nest is large and flat, made of sticks lined with wool and other soft materials. The eggs are four or five in number, of a greenish-blue, and about the size of those of a duck. Heronries were much prized in the days of falconry, and some are yet to be seen in several parts of the kingdom. In flying, this species hides its head between its shoulders, and its legs hang down. When it flies very high it presages a storm. If taken young, these birds may be tamed: but when the old birds are captured, they soon pine away, refusing every kind of nourishment. The body is very small and always lean, and the skin is scarcely thicker than membrane used by the gold beaters. Linnæus had made the two sexes distinct species, and others were long of the same opinion: but later observations have corrected the mistake.

510 *Garzetta.* *Egret*, or *little egret*.—Hind head crested; body white; bill black; lores and legs greenish; irides yellowish; crest consisting of some short, and two long feathers; face naked and green; claws black. Nearly a foot long, and weighs one pound. Inhabits marshy places, in temperate regions, in the four quarters of the world. If we may judge from the bill of fare of the famous feast given by the archbishop Nevil, these birds were formerly plentiful in England; for no fewer than 1000 were in that list. It is, however, now become a very rare bird in this kingdom. Its plumes were formerly used to decorate the helmets of warriors, but are now applied to ornament the head dresses of European ladies, and the turbans of the Persians and Turks. Its habits are analogous to those of the common heron.

511 *Egretta.* Plate CCCXCVIII. fig. 3. *Great egret*.—Somewhat crested, white; legs black; feathers of the back and breast lax, narrow and very long. About two feet long. Inhabits South America. Is shy and solitary, lying hid among the tall reeds, and feeding by night.

512 *Herodias.* *Great heron*.—Hind head crested; body brown; thighs rufous; breast with oblong black spots. Above five feet long. Inhabits the lakes and rivers of Virginia, and feeds on lizards, frogs, and fish.

513 *Cærulea.* *Blue heron*.—Hind head crested; body blue; bill and lores blue; legs green. In the female, the head and neck are dusky purple; the chin and middle of the throat white, and the back lead colour. There is a subcrested variety blue green, with the chin and throat white. Another is varied with brown, yellow, and cinereous; steel black above; white beneath; and wings and tail greenish. From 16 to 18 inches long. Inhabits America. Found in Carolina in spring, and in Jamaica, and other islands of the West Indies, in winter. It has also been met with at Otaheite, and other islands of the South seas, where it is much respected.

514 *Comata.* *Squacco heron*.—Ferruginous; white beneath; hind head with a long white pendent crest, edged with black. About 15 inches long. Inhabits Europe and Asia. A white variety, with a smooth head, the upper part, crown, breast and back reddish, and which inhabits Coromandel. Has been once shot in England.

515 *Stellaris.* *Bittern*; in provincial English, *bittour*, *bumpy coss*, *butter bump*, and *miredrum*.—Head smoothish; body testaceous above, with transverse spots; paler beneath, with oblong brown spots. About two feet and a half long. Inhabits Europe, Asia, and America, affecting the more temperate regions in winter, and migrating northwards in summer. Though not a plentiful species in Britain, it is occasionally found in the breeding season, in the less frequented reedy marshes, and swampy moors, well clothed with rushes, where it forms a nest on some stump, by collecting sedges or other coarse plants together. It lays four or five eggs of a light olive green colour, inclining to cinereous. At this season the male makes a singular bellowing noise, vulgarly supposed to be produced by the bird putting his bill into a reed. It is with difficulty roused from its lurking place, flies heavily, and frequently lights again at a small distance, so that it becomes an easy prey to the sportsman. About sunset, it sometimes soars to a great height in the air, with a spiral ascent, making at the same time a loud and singular noise. Its flesh is accounted a delicacy.

516 *Botaurus.* *Greater bittern*—Head smoothish, black; body cinereous brown above; rufous beneath; lores and naked orbits yellow; throat white, streaked with black and reddish. Three feet nine inches long. Inhabits Italy.

517 *Alba.* *Great white heron*.—Head smooth; body white; bill tawney; legs black; bill six inches long; irides yellowish; lores green. Three feet six inches long. Inhabits Europe, Asia, and America. Is rare in England.

518 *Carunculata.* *Wattled heron*.—Back, wings, legs and crown black-blue; smooth head and neck white; body black beneath; bill and chin caranculated. Five feet long. Inhabits Africa.

519 *Exilis.* *Minute bittern*.—Smooth head and upper part of the body reddish-bay; white beneath; sides of the neck rufous; wings and tail black. Twelve inches and a half long. Inhabits Jamaica.

520 *Minuta.* *Little bittern*.—(Male). Head smooth; body brown; reddish beneath; tail feathers greenish black; lores yellowish. (Female). Body brown; edges of the feathers reddish; reddish beneath; crown, back, wings and tail black; bill yellow green; naked part of the face yellow; irides saffron; legs green brown. This beautiful species is scarcely larger than a fieldfare, and about 15 inches long, from the tip of the bill to the end of the tail. The female lays four or five white eggs, of the size of those of the blackbird, and which are placed on a

Grallæ. a few dried flags on the ground. Inhabits Europe and Asia, but is rare in England.

E. *Bill gaping in the middle.*

521 *Pondiceriana.* *Pondicherry heron.*—Gray-ash; quill feathers long and black; middle claw not serrated; bill yellow, thick at the base, pointed at the tip, and a little bent in, gaping in the middle; space between the bill and eyes feathered; legs yellow. Fourteen inches and a half long. Inhabits India.

522 *Coromandeliana.* *Coromandel heron.*—White; back, wings and tail black; upper mandible serrated from the middle to the tip; bill yellow, thick at the base, and pointed at the tip; legs reddish-yellow; upper part of the head with black lines; lores and chin naked and black; irides red; toes connected at the base. Inhabits Coromandel, and feeds on fish and reptiles.

523 *Scolopacea.* *Scolopaceous heron.*—Brown; throat and breast streaked with white; chin and legs white; wings and tail copper-colour. Twenty-five inches long. Inhabits Cayenne.

524 TANTALUS. Gen. 52. TANTALUS, *Ibis.*

525 Characters. Bill long, subulated, roundish, somewhat arched; face naked; tongue short and broad; jugular pouch naked; nostrils oval; feet four-toed and palmated at the base.

526 *Loculator.* *Wood ibis.*—Face bluish; bill reddish; legs, quill and tail feathers black; body white; bill nine inches long, yellowish-brown; irides reddish. The male has the head and neck naked, wrinkled and black-blue; and the female has the neck gray and downy. Three feet long. Inhabits New Holland and the warmer parts of America. Is stupid and slow in flight, sitting on trees, and feeding on herbs, seeds, fruits, fish, and reptiles. The flesh is good. Of this species there are two varieties, the first having the head and neck white, blended with yellow, the body black, and belly cinereous; and the second distinguished by white wing-coverts, with a black blotch in the middle.

527 *Igneus.* *Glossy ibis.*—Head and neck black; legs green; body varied with glossy-blue, blackish, green and claret; dark rufous beneath; quill and tail feathers green-gold; bill green. Thirteen inches and a half long. Inhabits Russia, and was once shot in Cornwall.

528 *Niger.* *Black ibis.*—Face, bill, and legs reds; body black. From 30 to 40 inches long. Inhabits Egypt.

529 *Ibis.* *Egyptian ibis.*—Face red; bill pale yellow; quill feathers black; body reddish-white. This is a large bird, somewhat exceeding the stork, and measures from 30 to 40 inches in length. The bill is seven inches long, the colour yellow, growing reddish towards the tip, slightly curved, and ending in a blunt point. The fore part of the head, all round as far as the eyes, is naked and reddish. The skin under the throat, is also bare and dilatable; the plumage reddish white, most inclining to red on the back and wings; quills and tail black; the legs long; and the thighs bare for three parts of their length. Hasselquist adds that the irides are whitish, and the end of the bill and the legs black; and that it is found in Lower Egypt, in great plenty, in places just freed from the inundations of the Nile. It lives on frogs and insects, and is seen in gardens morning and evening, and sometimes so abundantly, that whole palm trees are covered with them. When at rest they sit quite erect, their tail touching their legs. The same author believes it to be the ibis of the ancients; first, because it is common in, and peculiar to Egypt; secondly, as it eats serpents; and, thirdly, because the urns which contain the remains of embalmed birds, found in the sepulchres along with the mummies, seem to contain birds of this size. Its figure represented Egypt, in the hieroglyphic writing of its inhabitants. In that country it is still called *Pharaoh's bird*, and builds in the palm trees.

530 *Rubra.* *Scarlet ibis.*—Face, bill and legs red; body scarlet; wings tipt with black. Twenty-one inches long. Inhabits South America. Sits on trees, but lays its greenish eggs on the ground. The young are at first black, then gray, whitish just before they fly, and afterwards grow gradually red.

531 *Alba.* Plate CCCXCVIII. fig. 1. *White ibis.*—This species is 22 inches long, and about the size of the whimbrel; the face, bill and feet reddish; body white; tips of the wings green; the male and female nearly alike. Native of Brazil, but towards the end of summer migrates to the north, and is found in great numbers in the marshy lands of Carolina, feeding on fish and aquatic insects. Here they remain for about six weeks: the fat and flesh of the white ibis are said to be of a saffron colour, but though not much esteemed, is sometimes eaten.

532 CORRIRA. Gen. 53. CORRIRA, *Courier.*

533 Characters. Bill short, straight, toothless; thighs longer than the body; feet four-toed, palmated; hind toe unconnected.

534 *Italica.* *Italian courier.*—Ferruginous above; white beneath; two middle tail feathers white, tipt with black; bill pale yellow, black at the end, with a large gap; irides a double circle of bay and white. Less than the curlew. Inhabits Italy, and runs swiftly.

535 SCOLOPAX. Gen. 54. SCOLOPAX.

536 Characters. Bill roundish, obtuse, and longer than the head; nostrils linear; face covered with feathers; feet four-toed; hind toe consisting of many joints.

The birds of this and of the succeeding genus are with difficulty ascertained, being subject to differ in appearance from sex and age, and their colours shading into one another. The markings of their feet, however, are pretty constant, and therefore afford one of the best criteria.

537 *Pygmea.* *Pigmy curlew.*—Arched bill, and legs black; body varied with ferruginous, brown, and white; white beneath; rump white; quill and outer tail feathers edged with white. Size of a lark. Inhabits Europe, and is very rare in England.

538 *Arquata.* *Common curlew.*—Bill arched, blackish; legs bluish; wings blackish, with snowy spots; lower mandible reddish at the base; body above, and breast, streaked with dusky brown; chin, rump, belly, and vent, white; quill feathers black, spotted with white within; legs bluish; toes flat and broad. This species is subject to vary considerably in size, weighing from 20 to upwards of 30 ounces; the length of the largest being about 25 inches. Inhabits the moist and fenny places of Europe, Asia, and Africa. A rufous and black variety, with a smaller body, and longer bill, occurs in America. The curlew

Grallæ. curlew is common on most of our coasts, in winter, when it is gregarious, and feeds on small crabs, and other marine insects and worms. In the spring it retires inland, and commonly to the more northern parts of the kingdom, to breed, resorting to the most retired situations on the heath-covered mountains, or in extensive and unfrequented marshes. It makes no nest; but deposits among the heath, rushes, or long grass, four eggs, of a pale olive colour, marked with brownish spots. The young make use of their legs as soon as they are hatched, but cannot fly for a considerable time. The flesh of this species is eatable, but is best in summer, when the bird feeds on frogs, worms, and water insects. In winter it is rank and fishy.

539 *Phaeopus.* *Whimbrel.*—Bill arched, and black; legs bluish; back with rhomboid brown spots; rump white; lower mandible reddish at the base; body above, and breast brownish, with dusky brown streaks; chin, rump, belly, and vent, white; tail brown, with dusky bars; quill feathers black, spotted with white on the inside. About half the size of the preceding; but agreeing with it in appearance and habits. It is also more scarce in this country.

540 *Nigra.* *Black snipe.*—Bill and legs red; body black. Inhabits the islands between Northern Asia and America.

541 *Nutans.* *Nodding snipe.*—Bill black; legs greenish; body cinereous; crown and upper part of the back dusky red, and streaked; the lower white, spotted with black. Size of the common snipe. Inhabits Labrador, and is constantly nodding the head.

542 *Rusticola.* *Woodcock.*—Bill straight, reddish at the base; legs cinereous; thighs covered; head, with a black band on each side; upper mandible longer, reddish at the base; front cinereous; lower eyelid white; crown, neck above, back, and wing-coverts, ferruginous, mixed with black and gray; chin pale ash; threat yellowish, with small dusky spots; body whitish beneath, with dusky lines; quill feathers dusky, with triangular rufous spots; tail rounded, cinereous at the tip; legs brownish. Length 15 inches; weight from 12 to 15 ounces. This well-known species is subject to great variety, and inhabits the northern countries of Europe, Asia, and Africa, migrating in winter to the more temperate regions. In Britain it seldom appears in numbers till about the middle of November; but some occasionally appear as early as the latter end of September, or beginning of October. They generally come to us with northerly or easterly winds, when the more northern countries become frozen; and if the frost in those parts where they breed is suddenly severe, large flights are sometimes met with on our coasts, where they remain for a day, to recruit their strength, and then disperse. In England they are not so plentiful as formerly, when the art of shooting flying was less practised. A great many, however, are yet to be found in the more uncultivated parts of Devonshire, Cornwall, and Wales, as well as in the north of Scotland; but they are nowhere so abundant as in the large tracts of woods in Ireland. In severe weather, they accumulate, from the moors and inland counties, to the woods in the west of England. It is one of the few winter birds that occasionally breed with us. It builds a nest of a few fibres, or dry leaves, on the ground, generally at the root of a tree, and lays four eggs, somewhat larger than those of a pigeon, of a yellowish white, spotted and blotched with rufous brown and ash colour. Its usual food is insects and worms, for which it bores with its bill into moist places, feeding principally at night, when its call resembles that of the snipe. In some countries the woodcock remains the whole year, only moving in the breeding season, from the plains to the mountains. In this country, it usually prepares for its departure about the middle of March, when flocks come down to the sea coast, and, if the wind is favourable, are soon out of sight; but if it be contrary, they linger till it change.

Little woodcock.—Bill straight; legs brownish; front cinereous; hind head black, with four transverse yellowish lines; chin white; body above black, waved with slight tawney; yellow beneath. Eleven inches and a half long. Inhabits America. Its flesh is reckoned exquisite. 543 *Minor.*

Great snipe.—Legs and crown black, the latter with a pale divided line down the middle, a pale streak above and beneath the eyes; body varied above, white beneath; bill like that of the woodcock; lower feathers of the body, except the middle of the belly, edged with black; quill feathers dusky; tail feathers reddish, and, except the two middle ones, with black lines. Weighs about eight ounces; length 16 inches. Inhabits Siberia, and very rarely England. 544 *Major.*

Common snipe.—Bill straight, tuberculated; legs brown; body varied with blackish and tawney, white beneath; front with four brown lines; crown, bill, ocular band, and wings, black; chin pale rusty; tail-feathers black at the base; rump variegated. The weight of this species is about four ounces, and the length nearly 12 inches. It is met with in marshy situations, in almost every part of the world, and is very plentiful in our own island. In very wet times it resorts to the hills; but more generally frequents the marshes of the plains, where it can penetrate the earth with its bill, in quest of worms. Some few remain with us the whole year, and breed in the more extensive marshes and mountainous bogs. The nest is made of the materials around it, as coarse grass or heath, and placed on a dry spot, near a splash or swampy place, the eggs, like that of the lapwing, being much pointed, and invariably placed with their smaller ends inwards. In the breeding season the snipe changes its note entirely. The male will keep on the wing for an hour together, mounting like a lark, uttering a shrill piping noise, and then descend with great velocity, making a bleating sound, like that of an old goat, which is alternately repeated round the spot possessed by the female, especially while she is sitting on her nest. The young ones run off soon after they are freed from the shell; but they are attended by the parent birds, until their bills have acquired a sufficient firmness to enable them to provide for themselves. When undisturbed in its retreats, the snipe walks leisurely, with its head erect, and keeps moving the tail at short intervals. But it is rarely observed in this state of tranquillity, being extremely watchful, and perceiving the sportsman, or his dog, at a great distance, and either concealing itself among the variegated withered herbage, so similar in appearance to its own plumage, that it is almost impossible to discover it, or, as happens more frequently, springing and taking flight beyond the reach of the gun. When first disturbed it utters a kind of feeble whistle, and generally flies against the wind, turning nimbly in a zig-zag direction, and 545 *Gallinago.*

Grallæ. and sometimes soaring almost out of sight. From its vigilance and manner of flying, it is very difficult to shoot; but some sportsmen can draw it within range of their fowling-piece, by imitating its cries, and others are contented to catch it in the night by springes. The snipe is much esteemed as a delicious and well flavoured dish; and though it is very fat, it rarely disagrees even with the weakest stomach.

546 *Guallinula.* *Jack-snipe, judcock*, or *gid.*—Bill straight, tuberculated; body variegated; legs greenish; lores brown; rump varied with violet; bill black; body variegated with testaceous, black, violet, and glossy green; head with pale yellow and black lines, reaching from the bill to the hind head; breast spotted; belly and vent white. Eight inches and a half long. Inhabits Europe, Asia, and America. Is found in the same places with the preceding, but is more solitary and rare. It will lie among rushes, or other thick covert, till in danger of being trampled on, and, when roused, seldom flies far. It comes to us later than the common snipe, and is never known to remain in this country during the breeding season. It is as much esteemed as the snipe, and is cooked in the same manner.

547 *Glottis.* *Greenshank.*—Bill straight, the lower base red; body beneath snowy; legs greenish; bill black; the lower mandible bending a little upwards; eyebrows and lower part of the back white; head, neck, and back, pale cinereous; shafts of the feathers spotted with brown; quill feathers dusky, spotted with white on the inside; tail white, with dusky lines; legs very long. Weight about six ounces: length 14 inches. Inhabits Europe, Asia, and America. Is sometimes seen, in small flocks, on our coasts, in winter; as also in the marshes and fens contiguous to the sea. Some few are supposed to remain with us all the summer, and to breed in our fens. The greater part, however, retire northward to breed, and are found in Sweden, Russia, and Siberia. Their flesh, like all the rest of this genus, is well flavoured, and reckoned good eating.

548 *Calidris.* *Redshank*, or *pool-snipe.*—Bill straight, red; legs scarlet; secondary quill feathers white; bill black towards the tip; irides reddish hazel; head and neck cinereous above; back and shoulders greenish-brown; wing-coverts cinereous, mixed with dusky and brown, and spotted with whitish; secondary quill feathers, except the two inner ones, white towards the tip; primary dusky, the four or five inner ones tipt with white; line over the eyes white; a dusky spot between the bill and eyes; short dusky streaks on the chin and throat; under part of the body and rump white, with small dusky spots; each of the tail feathers with 12 or 13 transverse black lines. Weighs about five ounces, and is 12 inches long. Inhabits Europe and America. Is not uncommon in some parts of England, residing the greater part of the year in the fen countries, where it breeds and rears its young. It lays four eggs, which are whitish, tinged with olive, and marked with irregular spots of black, chiefly on the thicker end. When disturbed it flies round its nest, making a noise like a lapwing. It is not so common on the sea shores as several of its congeners, and is of a solitary disposition, being mostly seen alone, or only in pairs.

549 *Totanus.* *Spotted snipe, red-legged godwit*, or *spotted redshank.*—Blackish, with white spots; white beneath; lines on the breast and bands on the lateral tail feathers blackish; legs red. Size of the greenshank. Inhabits Europe, frequenting the banks of rivers, and feeding on the smaller shell-fish and other vermes. Seldom visits Britain.

Lesser godwit, judrake snipe, or *stone plover.*—Bill inclining a little upwards at the point, red at the base; body gray brown, varied with rufous; white beneath; quill feathers white at the base, the four first without spots; tail white at the base; irides whitish; cheeks reddish; back brown; quill feathers blackish; feathers round the bill reddish white. Seventeen inches long, and weighs nine ounces. Inhabits the north of Europe, and is gregarious; but seldom occurs in Britain. 550 *Limosa.*

Red godwit, or *red-breasted godwit.*—Bill a little recurved, yellowish; legs black; body reddish-rusty beneath; bill blackish at the tip; head, neck, breast and body, ferruginous above, and, except the neck, streaked with black; lower part of the back and rump rufous white; greater quill feathers black without, the base white within; secondary and tail feathers half black and half white. Weight about 12 ounces; length 18 inches. There is a variety with the head and neck cinereous, and the chin and belly white. Inhabits Europe and America, and is gregarious, but rarely seen with us. 551 *Lapponica.*

Common or *gray godwit.*—Bill straight, reddish yellow; legs greenish; head and neck reddish; three of the quill feathers black, with a white base; a broad white streak from the bill to the eye; body reddish-brown above; feathers with a dusky spot in the middle. Subject to very considerable variety both in size and plumage. In general, it weighs from seven to twelve ounces, and measures from 15 to 16 inches. It inhabits Europe, Asia, and Africa; continues with us the whole year, and resorts to the fens in spring for breeding. In the winter it is found on our shores, particularly at the mouths of large rivers and inlets, where the mud and sand become bare at low water, and where it feeds on insects. It is much esteemed by epicures as a great delicacy, and sells very high. It is caught in nets, to which it is allured by a *stale*, or stuffed bird, in the same manner, and at the same season, as the ruffs and reeves. 552 *Ægocephala.*

Godwit.—Brown, edged with whitish; neck whitish, with small brown spots; chin and belly white; quill feathers with black bands; bill a little turned up, brown, with a purple base; tail feathers white; the two middle ones wholly, the rest barred with brown on the outer side. Sixteen inches long. Inhabits Europe. Regarded by some ornithologists as only a variety of the *ægocephala.* 553 *Leucophæa.*

Cinereous godwit.—Legs long, cinereous; head, neck, and back varied with cinereous and white; chin and breast white, spotted with ash; bill thicker than in the greenshank; tail with cinereous lines. Size of the greenshank. Inhabits Licolnshire; but is very rare, and seems to be imperfectly known. 554 *Canescens.*

Cambridge godwit.—Legs orange; bill red; body brown ash above, white beneath; wing-coverts and tail feathers barred with black; lesser wing-coverts brown, edged with white and barred with black; quill feathers blackish, white within; the secondary barred with white. Larger than the redshank. Was shot near Cambridge, and first described by Pennant. 555 *Cantabrigiensis.*

Grallæ.

Gen. 55. Tringa, *Sandpiper*.

556 Tringa. Bill roundish, as long as the head; nostrils small, linear; tongue slender; feet four-toed; hind toe of

557 Characters. one joint, and raised from the ground.

The birds of this genus frequent the plains and shores, and hardly touch the ground with their back toe.

558 Pugnax. *Ruff* and *reeve*.—Bill and legs rufous; three lateral tail feathers without spots; face with flesh-coloured granulations; bill sometimes black or yellowish; irides hazel; back of the neck with a large tuft of feathers, which fall off in moulting season. Female pale brown; back spotted with black; tail brown; the middle feathers spotted with black; breast and belly white. The ruffs, or males, are so very variable in their markings, that two are seldom found alike. Buffon mentions that Klein compared above 100 ruffs together, and found only two that were similar. About one foot long. Inhabits Europe and Siberia. The male does not acquire the ornament of his neck till the second season, and, before that time, is not easily distinguished from the female, except by being larger. After moulting, at the end of June, he loses his ruff and the red tubercles of his face; and from that time, till the spring of the year, he again, in plumage, looks like his mate. These birds leave our island in the winter, and are then supposed to associate with other congenerous species. In the spring, as soon as they arrive again in England, and take up their abode in the fens where they were bred, each of the males (of which there appears to be a much greater number than of females) immediately fixes on a particular dry or grassy spot in the marsh, about which he runs round and round, until it is trodden bare, wishing, apparently, to invite the female to take joint possession, and become an inmate. As soon as a single female arrives, and is heard or observed by the males, her feeble cry seems to rouse them all to war; for they instantly begin to fight; and their combats are described as being both desperate and of long continuance, the female, at the end of the battle, remaining the prize of the victor. It is at the time of these battles, that they are caught in the greatest numbers in the nets of the fowlers. They are also at other times caught by day nets, and are drawn together by means of a stuffed reeve, which is placed in some suitable spot for that purpose. The ruff is much prized as a delicious dish, and is sought after with great eagerness by the fowlers who live by catching them and other fen birds, for the markets of the metropolis, &c. Before they are offered for sale, they are commonly put up to feed, for about a fortnight, on boiled wheat, and bread and milk, mixed with hemp-seed, to which sugar is sometimes added; in consequence of which mode of treatment they soon get very fat. In the beginning of May the female makes her nest in a dry tuft of grass, in the fens, and lays four white eggs, marked with rusty spots.

559 Vanellus. *Lapwing, pewit, bastard plover*, &c.—Legs red; crest pendent; breast black; bill black; irides hazel; crown shining black; crest on the hind head four inches long; cheeks and sides of the neck white; a black line beneath each eye; throat black; hind part of the neck mixed with white, ash-colour, and red; back and scapulars glossy green; some of the feathers with ferruginous tips; lesser wing-coverts shining black, blue, and green; greater quill feathers black, the four first with a white spot at the end; lesser black on the upper half, white on the lower; belly white; vent and tail coverts orange; outer tail feathers white; the rest on the lower half black, tipt with dirty white; upper white. Weighs between seven and eight ounces. Is found in most parts of Europe, as far north as Iceland; and in the winter is met with in Persia and Egypt. The chief food of the lapwings is worms; and sometimes they may be seen in flocks nearly covering the low marshy grounds in search of these, which they draw with great dexterity from their holes. When the bird meets with one of those rolls of earth that are thrown out by the perforations of the worm, it first gently removes the mould from the mouth of the hole, then strikes the ground at the side with its foot, and steadily and attentively waits the issue; while the reptile, alarmed by the shock, emerges from its retreat, and is instantly seized. In the evening, the lapwings pursue a different plan, running along the grass, and feeling under their feet the worms, which now come forth, invited by the coolness of the air. Thus they obtain a plentiful meal, and afterwards wash their bill and feet in the small pools or rivulets. They remain in this country the whole year. The female lays four olive-coloured eggs, spotted with black, on the dry ground, near some marsh, on a little bed of dry grass which she prepares. She sits about three weeks, and the young are able to run within two or three days after they are hatched. The parent exhibits the greatest attachment to them, and has recourse to very amusing artifices to allure boys and dogs from approaching them. In place of waiting the arrival of the enemies at the nest, she boldly pushes out to meet them. When as near as she dare venture, she rises from the ground with a loud screaming voice, as if just flushed from hatching, though, probably, at the same time, not within 100 yards of her nest. She then flies with great clamour and apparent anxiety, whining and screaming round the invaders, striking at them with her wings, and sometimes fluttering as if she was wounded. To complete the deception, she becomes still more clamarous as she retires from the nest. If very near, she appears altogether unconcerned; and her cries cease in proportion as her fears are increased. When approached by dogs, she flies heavily, at a little distance before them as if maimed, still clamorous and bold, but never offering to move towards the quarter where her young are stationed. The dogs pursue, in expectation every moment of seizing the parent, and by this means actually lose the young; for the cunning bird, having thus drawn them off to a proper distance, exerts her powers, and leaves her astonished pursuers to gaze at the rapidity of her flight. These birds, when tamed, clear gardens of worms and snails. Their flesh and eggs are both reckoned delicacies for the table. In winter they join in large flocks, but are then very shy. 560

Gambet, gambet sandpiper, or *red-legged horseman*.— Gambetta. Bill and legs red; body variegated with pale yellow, and cinereous; white beneath; bill tipt with black; irides yellowish green; wing-coverts and scapulars cinereous, and edged with yellow; first quill and tail feathers dusky, the latter edged with yellow. About the size of the greenshank. Inhabits the northern parts of Europe and America, but seldom occurs in France or England.

Welsh

Grallæ.

561 *Nigricans.* *Welsh sandpiper.*—Blackish-ash; chin and middle of the belly white; base of the bill and legs red. Eight inches and a half long. Inhabits Glamorganshire and Caermarthenshire.

562 *Interpres.* *Turnstone, Hebridal sandpiper,* or *sea-dotterel.*—Legs red; body black, varied with white, and ferruginous; breast and belly white; bill black, a little turned up at the tip; cheeks and neck black above; tail black in the middle, and white at the ends. Female more dusky; head varied with brown and whitish; neck blackish above. Though these are the usual characteristics, the species is very subject to varieties. About the size of a throstle; length nine inches and a half, and weight rather more than four ounces. Inhabits the sea coasts of Europe and America. Though not known to breed with us, it visits some of our shores in August, and departs in spring. The name has been given it from its manner of turning up the stones in search of worms and marine insects. It makes a slight nest on the dry ground or sand, and lays four olive-coloured eggs, spotted with black. This species is not uncommon in the north of Scotland.

563 *Striata.* *Striated sandpiper.*—Base of the bill and legs yellow; tail feathers white, barred with brown; most of the quill feathers white. Nearly 11 inches long. Inhabits Europe and North America. Feeds on shell-fish and mollusca, which it searches for at the ebb of the tides, and on insects which it catches, hanging over the water like a swallow.

564 *Macularia.* *Spotted sandpiper.*—Base of the bill and legs flesh colour; all the body spotted; eye-brows and double band on the wings white; bill dusky; body above greenish-brown, white, with dusky spots beneath; two middle tail feathers greenish-brown, the rest white, with dusky lines. Female without spots beneath. About the size of a thrush, and eight inches long. Inhabits Europe and North America; is migratory, and is sometimes, though rarely, found in Britain.

565 *Cinerea.* *Ash-coloured sandpiper.*—Cinereous above, white beneath; legs dusky green; head spotted with black; neck with dusky streaks; back and wing-coverts with concentric black semicircles, varied with cinereous and white; tail coverts black and white; tail cinereous, edged with white; breast spotted with black; membrane surrounding the toes narrow and toothed. Length about 10 inches; weight from four ounces and a quarter to five and three quarters. This species, like most of the tribe, is subject to considerable variety. It inhabits Europe and America; visits some parts of our coasts, in large flocks, in winter, and departs about the latter end of March or beginning of April.

566 *Fusca.* *Brown sandpiper.*—Pale brown, spotted with black above, white beneath; fore part of the neck streaked with black; tail cinereous; wing-coverts edged with whitish; bill and legs black. Size of a jack-snipe. Inhabits England, but is very scarce.

567 *Lincolniensis.* *Black sandpiper.*—White, varied with gray and brown spots above, with oblong brown and black spots beneath; two middle tail feathers all black. Size of a thrush. Inhabits England, chiefly in Lincolnshire.

568 *Lobata.* *Gray phalarope,* or *great coot-footed tringa.*—Bill subulate, and bent in at the tip; feet pinnate; breast waved with white; bill black; front white; crown dusky; neck pale ash above; back, rump, and shoulders dove-colour, with dusky spots; wing-coverts and quill feathers brown; breast and belly white; tail dusky, edged with cinereous; legs black; membrane round the toes indented. Size of the common purre; weight one ounce. Inhabits Europe, Asia, and America. Congregates about the borders of the Caspian sea, and is not common in Britain. In stormy weather, it swims in numbers on lakes; but in fine weather, is solitary among the fens.

569 *Hyperborea.* *Red phalarope,* or *cock coot-footed tringa.*—Bill subulated, bent in at the tip; feet pinnate; breast cinereous; sides of the neck ferruginous; bill black; band through the eyes blackish; bar on the wings white; rump with blackish bands. The female is gray above, rufous beneath, with the eyebrows and base of the tail reddish, and the rump white; bill yellowish; band above the eyes reddish; bar on the wings white, and the rump spotted with blackish. Eight inches long. Inhabits northern Europe and America; but is rarely met with in our own country. These birds go in pairs, and catch insects in the water with their bill. They do not dive, and are but bad swimmers. The female makes her nest on dry ground, and lays four eggs.

570 *Alpina.* *Alpine sandpiper,* or *dunlin.*—Brown testaceous; breast blackish; tail feathers whitish-ash; legs brownish; belly white; two middle tail-feathers a little longer. Weighs from nine to eleven drams; length of the largest eight inches. Inhabits Europe, Asia, and America, and is not uncommon on our own coasts during great part of the year. The female lays four eggs, of a dirty white, blotched with brown round the thicker end, and marked with a few small spots of the same colour on the smaller end.

571 *Ochropus.* *Green* or *wood sandpiper.*—Bill dotted at the tip; legs greenish; back brown green; belly and outer tail feathers white; bill greenish; crown and hind head dusky ash; rump variegated; eyebrows white. Inhabits Europe, North America, and Siberia. This elegant species weighs about three ounces and a quarter; length full 10 inches. It is by no means plentiful in Britain, and, except in pairing time, lives solitary. It is never seen near the sea; but frequents rivers, lakes, and other fresh waters. It runs on the shores, or skims the surface of the water. It utters a cry as it rises, and sometimes dives when pursued by the buzzard. It feeds on the fry of small fishes and worms. Though its flesh tastes somewhat of musk, it is considered as a great delicacy. It comes to us about the middle of September, and leaves us as late as the end of April, when it departs northward to breed.

572 *Littorea.* *Shore sandpiper.*—Smooth bill, and legs cinereous; quill feathers brown, the shaft of the first snowy. Near 11 inches long. Inhabits Europe; and is ranked by some ornithologists among British birds.

573 *Grenovicensis.* *Greenwich sandpiper.*—Body varied above; neck cinereous beneath; belly, vent, and sides of the rump white; bill black; legs greenish; crown brown, streaked with black; neck ash-coloured beneath; back and wing-coverts brown ferruginous, edged with whitish; hind part of the back, rump, and lesser wing-coverts cinereous; tail cinereous, the feathers waved towards the tip, which is pale rusty. Size of the preceding, but very rare. The circumstance of one having been shot near Greenwich, has given rise to the trivial name.

574 *Maritima.* *Sea* or *selninger sandpiper.*—Varied above with gray and black, white beneath; legs yellow; middle of the back

Grallæ. back violet; throat and tail dusky; four outer tail feathers very short, and edged with white. Size of a stare. Inhabits Norway and Iceland. A small flock of this species, consisting of 10 or 12, was once observed, some years ago, near Bexhill, on the 8th of December.

575 *Hypoleucos.* *Common sandpiper*.—Bill smooth; legs livid; body cinereous, with black stripes, white beneath; bill brown; irides hazel; head brown, with black streaks; eyebrows white; neck cinereous above; back and wings greenish-brown, with numerous, narrow, dusky lines; quill feathers brown, and, except the first, with a white spot within; tail rounded, and glossy-green brown. Weight about two ounces; length seven inches and a half. Inhabits Europe and America. Visits this country in the spring, chiefly frequenting our lakes and rivers, on the borders of which it makes a nest composed of moss and dried leaves, and most commonly placed in a hole in the bank. It lays four or five eggs of a dirty white, marked with dusky and cinereous spots, mostly at the larger end. When disturbed, it makes a piping noise as it flies; and, when running on the ground, the tail is constantly in motion. In autumn it is liable to be much infested with the *hippobosca hirundinis*.

576 *Canutus.* *Knot*.—Bill smooth; legs ash-coloured; primary quill feathers serrated; outermost tail feather white, without spots; bill dusky ash; irides hazel; lores dusky; eyebrows and band on the wings white; body cinereous above, white beneath; lower wing-coverts tipt with white; chin and breast with minute spots; belly and vent with dusky lines; rump with brown semicircles. Nine inches long, and weighs four ounces and a half. Inhabits Europe and America. In Lincolnshire, and the other fenny districts of England, it is caught, in great numbers, by nets, into which it is decoyed by carved wooden figures to represent itself. It is also fattened for sale, and esteemed by many equal to the ruff in the delicacy of its flavour. The season for taking it is from August to November, after which the frost compels it to disappear. This bird is said to have been a favourite dish with Canute king of England; and Camden remarks that its name is derived from his.

577 *Cinclus.* *Stint*, *purre*, or *sanderling*.—Bill and legs black; lores white; body and rump gray and brown; head and neck pale cinereous above, with brown streaks; back and wing-coverts brownish-ash, the greater tipt with white; throat white, mixed with brown; breast and belly white; two middle tail feathers more dusky, the rest edged with white: the legs are sometimes brown. The country people frequently call it *ox-bird*, *ox-eye*, *least snipe*, *sea-lark*, or *wagtail*. It is nearly eight inches in length, and weighs about an ounce and three quarters. Inhabits Europe, Asia, and America. During winter it is found on all our coasts, appearing in vast flocks, and especially affecting the flat sandy shores and inlets. They leave us in April, though it is suspected that some remain with us all the year. These birds run nimbly near the edges of the flowing and retiring waves, and are almost perpetually wagging their tails, while they are, at the same time, busily employed in picking up their food, which consists chiefly of small worms and insects. On taking flight, they give a kind of scream, and skim along the surface of the water with great rapidity, as well as with great regularity, not flying directly forward, but performing their evolutions in large semicircles, alternately approaching the shore and the sea in their sweep, the curvature of their course being indicated by the flocks appearing suddenly and alternately in a dark or in a snowy white colour, as their backs or their bellies are turned to or from the spectator.

Little sandpiper.—Bill and legs brown; body reddish 578 *Pusilla.* beneath; outer tail feathers with a white shaft; rump variegated; bill tipt with black; greater wing-coverts and quill feathers brown, tipt with white; tail dusky; breast and belly white. About the size of a hedge-sparrow, and between five and six inches long. Inhabits Northern Europe and Nootka Sound; and has been once or twice killed in England.

Gray sandpiper.—Bill black; legs greenish; body 579 *Squatarola.* gray, white beneath; head, back, and wing-coverts, edged with greenish-ash; cheeks and chin with oblong dusky spots, and with the belly and rump white; tail barred with black and white. Weight about 7 ounces; length 12 inches. Inhabits Europe and America. Is not plentiful on our shores, seldom more than six or seven being seen in a flock, and all of them retiring northward to breed. In Siberia and Carolina, it is said to be found in large flocks.

Red or *Aberdeen sandpiper*.—Bill and legs brown; 580 *Islandica.* body ferruginous beneath; secondary quill feathers edged with white; body thickly sprinkled with black, and ferruginous above; wing-coverts white on the outer edge; rump and vent whitish, the former waved with black, the latter with a few black streaks; quill feathers black, with white shafts; tail feathers cinereous, with white shafts. From eight to ten inches long. Inhabits the north of Europe and America. Sometimes appears in great flocks on the coasts of Essex and the north of Scotland. In summer it frequents the neighbourhood of the Caspian sea, and also the river Don. It is perpetually running up and down on the sandy banks, picking up insects and small worms, on which it feeds.

Gen. 56. CHARADRIUS, *Plover*. 581 CHARADRIUS.

Bill roundish, obtuse, straight; nostrils linear; feet formed for running, three-toed. 582 Characters.

The birds of this genus frequent the mouths of rivers, and the neighbourhood of torrents, and seem to enjoy rainy weather. From this last circumstance is derived their French name *pluvier*, and the English *plover*.

Ring plover, *ring dotterel*, or *sea lark*.—Breast black; 583 *Hiaticula.* front blackish, with a white band; crown brown; legs yellow; upper half of the bill orange, lower black; irides hazel; body gray-brown above, white beneath; eggs bluish-white, with small round purplish spots. Of this species there is also a gray variety, with the collar and belly white; and another gray-ash, with the front and collar white, and the lower half of the tail black, tipt with rusty; the former inhabiting Spain, and the latter America. The more common sort is a native of both Europe and America, and is a well known visitant of our shores in summer; usually arriving in spring, and migrating in autumn, or at least retiring to the more inland parts of the country. It weighs about two ounces, and is between seven and eight inches long. It pairs early in May, and makes no nest, but lays four eggs in a small cavity in the sand, just above high-water mark. They are of a cinereous brown, marked all over with small black and ash-coloured spots. It is to be remarked

Grallæ. ed, that these and other birds which lay invariably only four eggs on the ground, place them so as to occupy the least possible space, that is, with the small ends touching each other as a centre. The ringed plover is greatly attached to its young, and will practise various deceptions to save them from men and dogs; sometimes fluttering along the ground as if crippled, and sometimes seeming to tumble head over heels repeatedly, till it has enticed its enemy to a distance from its young, and then it flies off.

584 *Vociferus.* *Noisy plover.*—Bands on the breast, neck, front, and cheeks white; tail pale yellow, with a black bar; legs yellow. Between nine and ten inches long. Inhabits America. Is very restless and clamorous.

585 *Morinellus.* *Dotterel.*—Breast ferruginous; band over the eyes, and line on the breast white; legs black; bill black, depressed in the middle; front mixed with dusky and gray; hind head black, temples and chin white; upper part of the neck, back and wings, gray-brown; line across the breast white; middle of the belly black, reddish-white below; greater quill feathers brown, and some of them edged with white; tail olive brown, with a dusky band near the end, and tipt with white. The female is distinguished by a dusky band over the eyes, and brown crown. The crown of this species is sometimes varied with white, gray-brown, and yellowish; the body beneath yellowish, mixed with white; the two middle tail feathers brown, and the lateral ones white. Weight between four and five ounces; length nearly 10 inches. Inhabits Europe, and makes this island a resting station in its migratory flights to and from its breeding place. It is seen on some of our downs, heaths, and moors, from April to the beginning of June; returns again in September, and remains till November. On the Wiltshire downs, it resorts to the new sown corn or fallow-ground, for the sake of worms and beetles, its principal food. In the autumn it flies in flocks of five, six, or more. It is a stupid bird, and easily shot, but much esteemed for the delicacy of its flesh.

586 *Himantopus.* *Long-legged plover*, or *long shanks.*—White; back and wings black; bill black, longer than the head; legs red, and very long; bill black, slender, tapering to a sharp point, the upper mandible a little longer than, and bent over, the lower; irides red; neck dusky spots above. There is a variety with white and black wings, and the tail feathers white. This extraordinary species is certainly the longest legged bird, in proportion to its bulk, hitherto known; the length from the apex of the bill to the end of the tail being thirteen inches, and from that to the end of the toes, five inches more. It is rare in Britain, and in many parts of Europe, so that its manners are very imperfectly known. According to Latham, it is common in Egypt, being found there in the marshes in October. Its food is said to consist principally of flies. It is likewise plentiful about the salt lakes, and often seen on the shores of the Caspian sea, as well as by the rivers which empty themselves into it, and in the southern deserts of Independent Tartary. It is also often met with in the warmer parts of America, and sometimes in Jamaica.

587 *Pileatus.* Plate CCCXCIX. fig. 2. *Hooded plover.*—Bill and feet red; face naked, having a yellowish carunculated membrane; head and part of the neck black; hind head furnished with a few short pointed feathers hanging like a crest; beneath white; body above rufous gray; under part white. Ten and a half inches long. Native of Senegal. Grallæ.

Gen. 57. Recurvirostra, *Avocet.* 588 Recurvirostra.

Bill depressed, subulated, recurved, pointed, flexible at the tip; feet palmated, four-toed, hind toe not connected, very short, and placed high up; nostrils narrow, pervious; tongue short. 589 Characters.

Of this singular genus there are only three species, of which the first inhabits Europe. 590 *Avocetta.*

Scooping avocet.—In provincial English, *butter-slip*, *scooper*, *yelper*, *picarini*, *crooked bill*, *cobler's awl*, &c. Variegated with white and black; bill three inches and a half long; irides hazel; crown black, a white spot behind and beneath the eyes; rest of the head, neck, back, exterior part of the wings, lesser quill feathers, tail, and under part of the body white; inner scapulars, and greater quill feathers without and at the tips black; legs bluish, and very long membrane connecting the toes indented. Resides in the temperate parts of Europe; weighing thirteen ounces, and measuring, from the tip of the bill to the end of the tail, eighteen inches. It breeds in the fens of Lincolnshire, and on Romney Marsh, in Kent. The female lays two white eggs, tinged with green, and marked with large black spots. In winter these birds assemble in small flocks of six or seven, and frequent the shores, particularly the mouths of large rivers in search of worms and marine insects, which they scoop out of the mud or sand. They seem to be particularly fond of the *cancer pulex*, or *locusta*. By means of their long legs, they run over shores that are covered five or six inches with water. In their movements they are lively, alert, volatile, and difficult to catch. When the female is frightened off her nest, she counterfeits lameness; and, when a flock is disturbed, they fly with their necks stretched out, and their legs extended behind, over the head of the spectator, making a shrill noise, and uttering a yelping cry of *twit, twit*, all the time.

American avocet.—Head and neck reddish; back black, white beneath. Fourteen inches long. Inhabits North America and New Holland. 591 *Americana.* Plate CCCXCIX. fig. 1.

White avocet.—White; lower wing coverts brownish; bill orange; legs brown. Fourteen inches and a half long. Inhabits Hudson's bay. 592 *Alba.*

Gen. 58. Hæmatopus. 593 Hæmatopus.

Bill compressed, the tip an equal wedge; nostrils linear; tongue a third part as long as the bill; feet formed for running, three toed, cleft. 594 Characters.

Sea pie, or *pied oyster-catcher.*—Bill, eyelids, and legs red, the former sometimes tipt with black; irides scarlet; body sometimes totally black; frequently the head, neck, and body above black; white beneath; a small white spot under the eyes; breast with a white semicircular band; middle wing coverts at the tips, and greater, entirely white; quill feathers spotted with white on the inside; tail from the middle to the base white, lower half black; claws black. Weight seventeen ounces, length sixteen inches. Inhabits almost every sea shore, but seems never to quit the coast. Congregates in small flocks in winter, and chiefly subsists on marine insects 595 *Ostralegus.* Plate CCCXCIX. fig. 3.

Grallæ. sects and shell-fish, especially on oysters, which it seizes with great adroitness. It makes no nest, but deposits its eggs on the bare ground, above high water mark. The eggs are generally four, of an olivaceous brown, blotched with black, and somewhat larger than those of the lapwing. The male is very watchful at the time of incubation, and on the least alarm, flies off with a loud scream, and the female instantly runs from her eggs to some distance, and then takes wing. It is a shy bird, but becomes bolder when the young are hatched. The latter are capable of running as soon as they quit the eggs, and are led by their parents to their proper food. The young are easily tamed.

596 Glareola.

Gen. 59. Glareola, *Pratincole*.

597 Characters. Bill strong, short, straight, and hooked at the tip; nostrils at the base of the bill, linear and oblique; gap of the mouth large; feet four-toed, toes long, slender, connected at the base by a membrane; tail forked, consisting of twelve feathers.

598 *Austriaca.* *Austrian pratincole.*—Gray brown above; collar black; chin and throat white, breast and belly reddish-gray. Very subject to vary in its plumage. Inhabits the heaths of southern Europe. About nine inches long. Feeds on worms and aquatic insects; is very restless and clamorous, and lays about seven eggs.

599 *Senegalensis.* *Senegal pratincole.*—Bills, legs, and whole body brown. Nine inches and a half long. Inhabits near the Senegal, and also Siberia.

600 *Novia.* *Spotted pratincole.*—Brown, spotted with white; lower part of the belly and vent reddish-white, with black spots; bill and legs black. Size of the *austriaca*. Inhabits Germany.

601 Fulica.

Gen. 60. Fulica.

602 Characters. Bill convex; upper mandible arched over the lower at the edge; lower gibbous near the tip; nostrils oblong; front bald; feet four-toed and sub-pinnated.

Birds of this tribe frequent waters, and feed on worms, insects, and small fish. They have a compressed body; the bill thick, and bent in towards the tip; the upper mandible reaching far up the forehead, and the wings and tail short. They are divided into *gallinules* or *water hens*, and *coots*. The former have the feet cleft; the upper mandible membranaceous at the base, and the wings concave; while the latter have the toes surrounded by a scalloped membrane; the mandibles equal; nostrils oval, narrow and short.

603 Gallinule.

A. *Feet cleft.* *Gallinule.*

604 *Chloropus.* *Common gallinule*, or *moor hen*.—Front tawney; bracelets red; body blackish; bill red, with a greenish tip; irides red; body sooty above, mixed with olive; cinereous beneath; outer edge of the wings and lower tail-coverts white; legs greenish; toes flat and broadish. Weighs from 14 to 16 ounces; length 14 inches. Inhabits Europe and America, and is a very common species, being found in most sedgy and slow rivers, or streams of water, and frequently in ponds abounding in weeds, where it can lie concealed. It feeds principally on insects, seeds, and vegetable productions of various sorts, in quest of which it frequently quits the water. It runs fast, and is equally expert in swimming and diving, but flies heavily, and with its legs hanging down. As it runs or swims, it is continually flirting up the tail, when the white underneath is very conspicuous. The nest is made of flags or rushes, and placed near the surface of the water, on some branch of a tree or bush, and sometimes on the stump of an old willow. The eggs are commonly five or six, but sometimes nine or ten, of a light yellowish brown, marked with rust-coloured spots. The young are hatched in about three weeks, and instantly take the water. This species breeds twice or thrice in the course of a season. Its flesh is reckoned delicious.

605 *Porphyrio.* *Purple gallinule.*—Front red; bracelets many; body green; violet beneath. Fifteen inches long. Common in most temperate and warm countries. Is docile and easily tamed. Stands on one leg, and lifts the food to its mouth with the other. Feeds on fish, roots, fruits, and seeds.

606 Coot.

B. *Feet pinnated.* *Coot.*

607 *Atra.* Plate CCCXCIX. fig. 4. *Common*, *black*, or *bald coot*.—Front flesh-coloured; bracelets greenish-yellow, body blackish; bill yellowish-white; front, except in pairing time, white; legs yellowish green; outer edge of the wings white. There are several varieties. Length 18 inches; weight from 20 to 30 ounces. Inhabits Europe, Asia, and America. It occurs in Great Britain at all seasons of the year, and is not supposed to migrate to other countries, but changes its stations, and to remove from the pools, where the young have been reared to the larger lakes, where flocks assemble in the winter. The female commonly builds her nest of a great quantity of coarse dried weeds, well matted together, and lined within with softer and finer grasses, in a bush of rushes surrounded by the water. She lays from 12 to 15 eggs at a time, and commonly hatches twice in a season. Her eggs are about the size of those of a pullet, and of a pale brownish-white colour, sprinkled with numerous small dark spots, which, at the thicker end, seem as if they had run into each other, and formed bigger blotches. As soon as the young quit the shell, they plunge into the water, dive, and swim about with great ease, but they still gather about the mother, and take shelter under her wings, and do not entirely leave her for some time. They are first covered with a sooty-coloured down, and are of a shapeless appearance; and, while in this state, before they have learned by experience to shun their enemies, they are often sacrificed to the rapacity of the pike, the kite, moor-buzzard, &c. A female of this species built her nest in Sir William Middleton's lake at Belsay, in Northumberland, among the rushes, which were afterwards loosened by the wind, so that the nest was driven about, and floated on the surface of the water; notwithstanding which, she continued to sit as usual, and brought out her young on her moveable habitation. The common coot swims and dives with great ease, but is a bad traveller, and may be said not to walk, but to splash and waddle between one pool and another, with a laboured, ill balanced, and awkward gait. During the day it usually skulks among the rushes or other water plants, rarely venturing abroad, except in the dusk, or at night, in quest of herbage, seeds, insects, and fishes. The sportsman and his dog can seldom force it to spring from its retreat, as it will rather bury itself in the mud than take wing, or,

if it be very closely pursued, and compelled to rise, it gets up with much flustering and apparent difficulty.

608 *Aterrima.* *Greater coot.*—Front white; bracelets red; body blackish. Has much the appearance and manners of the last, but is larger and blacker. It is found both in England and Scotland. The French eat it on meagre days.

609 *Cristata.* *Crested coot.*—Blue black; naked front and crown red; caruncle red, bifid, erect; bracelets red, green, and yellow; bill whitish, with a red base; legs dusky. Eighteen inches long. Inhabits China and Madagascar.

610 VAGINALIS.

Gen. 61. VAGINALIS, *Sheath-bill.*

611 Characters. Bill strong, thick, conical, convex, and compressed; upper mandible covered above with a moveable horny sheath; nostrils small, placed before the sheath; tongue round above, flattened beneath, and pointed at the tip; face naked and papillous; wings with an obtuse excrescence under the flexure; legs strong; four-toed; naked a little above the knees; toes rough beneath; claws grooved.

612 *Alba.* *White sheath-bill.*—Bill black at the base; sheath a horny yellow or black plate, nearly covering the nostrils; face naked; and in the adult bird, beset with white, or pale orange warts; a brown or blackish wart above the eyes, larger than the rest; feathers white; excrescences on the wings blackish; legs two inches long, and generally reddish. The only species of the genus; about the size of a pigeon. From 15 to 18 inches long; inhabits New Zealand and the South seas, and feeds on shell-fish and carcases.

631 PARRA.

Gen. 62. PARRA, *Jacana.*

614 Characters. Bill tapering, somewhat obtuse; nostrils oval, in the middle of the bill; front covered with lobated caruncles; wings spinous.

615 *Chilensis.* *Chilese jacana.*—Claws moderate; legs brown; hind head subcrested. Inhabits Chili. Size of a jay, but has longer legs; feeds on worms and insects; is noisy, and defends itself by the spurs on the wings. Builds in the grass, and lays four tawney eggs, speckled with black.

616 *Jacana.* *Chesnut jacana.*—Hind claws very long; legs greenish. Ten inches long; inhabits watery places in South America, and utters, almost unceasingly, a shrill disagreeable cry.

617 *Chavaria.* *Faithful jacana.*—Toes long; legs tawney; hind head crested; bill dirty white; upper mandible like that of the dunghill cock; a red membrane on both sides at the base of the bill, extending to the temples, in the middle of which are the eyes; irides brown; hind head with about 12 blackish feathers; three inches long, forming a pendent crest; rest of the neck covered with thick black down; body brown; wings and tail blackish; wing-spurs two or three, and half an inch long; belly light black; thighs half bare; toes so long as to entangle each other in walking. About the size of a cock, and stands a foot and a half from the ground. Inhabits the rivers and inundated places near Carthagena in America; feeds on herbs; has a clear and loud voice, a slow gait, and easy flight. The natives keep one of these birds tame to wander with the poultry, and defend them against birds of prey, which it does by means of the spurs on its wings. It never deserts the charge committed to its care, and brings them home at night. It will readily suffer itself to be handled by grown up persons, but not by children.

Gen. 63. RALLUS, *Rail.* 618 RALLUS.

Bill thickish at the base; attenuated on the back towards the tip; compressed; a little incurved and pointed; tongue rough at the tip; body compressed; tail short; feet four-toed and cleft. 619 Characters.

The birds of this genus have the bill a little inflected; small nostrils; tongue rough; and the tail very short.

Land rail, crake, corn-crake, daker-hen, &c.—Wings reddish-rusty; bill and legs brown-ash; irides hazel; feathers of the body reddish-brown; the upper ones black in the middle; chin very pale; belly whitish-yellow. About nine inches and a half long. Inhabits the sedgy parts of Europe and Asia. From its appearing at the same time with the quail, and frequenting the same places, it is sometimes called *king of the quails*. Its well known cry is first heard as soon as the grass becomes long enough to shelter it, and continues till the grass is cut; but the bird is seldom seen, as it skulks in the thickest parts of the herbage, and runs so nimbly through it, winding and doubling in every direction, that it is difficult to come near it. When hard pushed by the dog, it sometimes stops short and squats down, by which means its too eager pursuer overshoots the spot, and loses the trace. It seldom springs but when driven to extremity, and generally flies with its legs hanging down, but never to a great distance. As soon as it alights, it runs off, and before the fowler has reached the spot, the bird is at a considerable distance. It is a migrative species, appearing with us about the latter end of April, and departing in October. On its first appearance, and till the female begins to sit, the male is frequently heard to make a singular kind of noise, much resembling that of a comb when the finger is drawn along the teeth of it, and which has been used as a decoy. When they first arrive, they are very lean, but before their departure, become excessively fat, and are much sought after for the delicacy of their flesh. 620 *Crex.*

Water rail, brook ouzel, bilcock, velvet runner, &c.—Wings gray, spotted with brown; flanks spotted with white; bill orange beneath; bill black, reddish at the base; irides red; feathers of the upper part of the body olive-brown, and black in the middle; the lower ones cinereous; those of the lower part of the belly and vent edged with rufous; quill feathers dusky; lower tail coverts white; tail feathers short, black; the two middle ones at the tip, the rest edged with ferruginous; legs dusky red. Length about 12 inches; weight four ounces. Inhabits watery places in Europe and Asia. Though not very plentiful, it is sometimes found in various parts of Great Britain, in low situations, about water courses and rivulets, where it seeks shelter among sedge-rushes, and reeds, and is seldom put to flight, depending chiefly on its legs for safety. When roused, it flies only a small distance, and that in a heavy and awkward manner, with its legs hanging down. It runs nimbly, and frequently flirts up its tail. The nest is made 621 *Aquaticus.*

Grallæ. made of sedge and coarse grass among the thickest aquatic plants, or in willow beds. The female lays six or more eggs, rather larger than those of a blackbird, very smooth, and of a pure white. This bird continues with us all the year, and by many is erroneously believed to be the land rail metamorphosed in the autumn, without knowing perhaps that the latter leaves this country at that season, and that the difference of the bills alone constitutes an essential distinction.

622 Porzana. *Spotted gallinule*, or *spotted water-hen*.—Two middle tail feathers edged with white; bill and legs pale olive; bill greenish-yellow; irides hazel; head brown, spotted with black; line over the eyes pale gray; neck above, and flanks brown-ash, with small white spots; back and wing-coverts olive, with black stripes, and near the edges of the feathers with white spots; the greater with white stripes and lines; cheeks, chin, and throat, pale gray, with brown spots; breast brown, with white spots; belly varied with cinereous and white; vent ochre-yellow. The weight of this elegant species is about four ounces; length nine inches. Inhabits Europe and North America; is migrative and scarce in England, and seems to have the manners and habits of the preceding.

623 Niger. *Black rail*.—Black; bill red at the base, brown at the tip; legs brown or red. Nine inches long. Inhabits Africa.

624 Pusillus. *Dwarf rail*.—Stripped with ferruginous and black; body black beneath, with narrow white bands; throat and breast bluish. Size of a lark. Inhabits near the salt lakes of Dunria.

625 Psophia.

Gen. 64. Psophia, *Trumpeter*.

626 Characters. Bill cylindrical, conical, convex, somewhat pointed; the upper mandible longest; nostrils oval and pervious; tongue cartilaginous, flat, and fringed at the tip; feet four-toed and cleft.

627 Crepitans. *Gold-breasted trumpeter*.—Black; back gray; breast glossy-green; orbits naked, red; bill yellowish-green; legs strong, tall, brownish ash or green; the back toe a round protuberance beneath, at a little distance from the ground; tail very short; feathers of the head downy; of the lower part of the neck squamiform; of the shoulders ferruginous, lax, pendulous, and silky; scapulars long and hanging. The *agami* of voyagers and others. Nearly 22 inches long, and about the size of the common domestic fowl. Inhabits South America, particularly the interior of Guiana, in considerable troops. In its native haunts is not distrustful of man, and is susceptible of domestication in an eminent degree, acquiring many of the social habitudes of the dog. It emits from the lungs a harsh and uncommon noise, not unlike that of a child's trumpet. It stands on one leg, and sleeps with its neck drawn in between the shoulders.

628 Undulata. *Undulated* or *African trumpeter*.—Crest of the hind head short, whitish; that of the breast long, black, and pendent. Size of a goose. Inhabits Africa.

629 Gallinæ.

Order V. GALLINÆ.

630 Characters. Bill convex; the upper mandible arched and dilated at the edge over the lower; nostrils half-covered with a convex cartilaginous membrane; tail feathers more than 12; feet cleft, but connected at the innermost joint; claws broad; toes scabrous below, and formed for scratching up the ground. In most species the males have spurs on the legs. They live chiefly on the seeds of plants, but likewise eat insects, grubs, and worms, which are macerated in their crop. They are polygamous, and build rude nests, for the most part, on the bare ground, the female laying many eggs at a time. They collect their young about them by a particular cry when they feed them, and lead and protect them till they moult. They are easily tamed, and are useful on account of their flesh, their eggs, and their feathers. Gallinæ.

Gen. 65. Otis, *Bustard*. 631 Otis.

Bill somewhat convex; nostrils oval and pervious; tongue bifid, pointed; feet formed for running; three-toed; tall; naked above the thighs. 632 Characters.

Great bustard.—Wave spotted, with black and rufous; whitish beneath; head (of the male) and each side of the throat crested; head and neck cinereous; quill feathers black; tail with rufous and black lines, and from 18 to 20 feathers; pouch beginning under the tongue, and reaching to the breast; long, capacious, and fit to hold near seven quarts of water; legs dusky. The male weighs from 20 to 30 pounds, and the female about 10 or 12; length about four feet. Inhabits the open plains of Europe, Asia, and Africa. It is the largest of British birds, and is now almost extinct in our island. It makes no nest, but the female lays her eggs in some hole in the ground, in a dry corn field. The eggs are two in number, as big as those of a goose, and of a pale olive-brown, marked with spots of a deeper colour. If during her absence from the nest, any one handles, or even breathes on the eggs, she immediately abandons them. Bustards feed on green corn, the tops of turnips, and various other vegetables, as well as on worms; and they have also been known to eat frogs, mice, and young birds of the smaller kind, which they swallow whole. They are remarkably shy and timid, carefully avoiding mankind, and being easily driven away in whole herds by the smallest dog. They are slow in taking wing, but run with great rapidity; and the young are even sometimes coursed and taken by greyhounds. Though not properly migratory, they leave their usual haunts in very severe winters, when the downs are covered for any length of time with snow, and repair to the more inclosed and sheltered situations in small flocks, and even stray to a great distance. In the Crimea they are seen in large flights, especially during winter, when the wings and crop feathers are sometimes so encumbered with ice, that the bird is unable, in the snow, to take the run previous to flying, in consequence of which many are caught by the hand, or by means of dogs, and brought to market alive. The flesh, particularly of the young, when kept a little time, is excellent. 633 Tarda.

Arabian bustard.—Ears with erect crests. Size of the preceding. Inhabits Asia and Africa. 634 Arabs.

Little bustard, or *field duck*.—Head and throat smooth; bill gray-brown; crown black, with rufous bands; temples and chin reddish white, with small dark spots; neck (of the male) black, with a white collar; body above varied with black, rufous, and white; beneath 635 Tetrax.

Gallinæ.

and outer edge of the wings white. About the size of a pheasant; length 17 inches. Inhabits Southern Europe and Asia. A few instances are on record of its having been found in England. In France, it is frequently served at table as a delicacy, though the flesh be blackish. In June it lays from three to five eggs, of a glossy green, and the young are able to fly in August.

636 *Afra.* Plate CCCC. fig. 1.

White-eared bustard.—Black; back cinereous; ears white; in the male the bill and legs are yellow; the crown is cinereous, and the wings are marked with a large white blotch, the neck behind, and thighs above the knees, have a white collar; the tail feathers 14; the female is cinereous, and the thighs and belly black. Length 22 inches. Native of the Cape of Good Hope.

637 *Houbara.*

Ruffed bustard.—Yellowish, spotted with brown; feathers of the neck long, whitish, with black shafts; quill feathers black, with a white spot in the middle. Size of a capon. Inhabits Africa and Arabia.

638 *Oedicnemus.*

Thick-kneed bustard, stone curlew, or *Norfolk plover.*—Gray; two first quill feathers black, white in the middle; bill sharp pointed; legs cinereous; bill black; legs greenish-yellow; lower eyelid naked, pale yellow; a yellow line above and beneath the eyes; a brown line from the bill, under the eyes to the ears; knees thick, as if swollen; belly and thighs white. Weighs about 17 ounces; length 18 inches. Inhabits Europe, Asia, and Africa. With us it is a migrative species, making its first appearance the latter end of April, or beginning of May, when the male is heard to make a very loud shrill noise, particularly in the dusk of the evening. It chiefly frequents large corn fields, heaths, or warrens, in open hilly situations; makes no nest, but lays two light-brown coloured eggs, blotched and streaked with dusky, on the ground. Its food chiefly consists of insects and worms, and sometimes also of mice, frogs, and toads. In the autumn, these birds assemble in small flocks preparatory to their departure, and are seldom seen after the beginning of October. When flying, they stretch out their feet straight behind, like the heron. The young are hardly to be distinguished from the stones in which they generally harbour.

639 STRUTHIO.

Gen. 66. STRUTHIO.

640 Characters.

Bill subconical; nostrils oval; wings short, unfit for flight; feet formed for running.

641 *Camelus.* Plate CCCC. fig. 2.

Black ostrich.—Feet with two toes; head small; bill horn-colour; irides hazel; eyelids fringed, head and greater part of the neck bald, flesh-coloured, with a few scattered hairs; feathers of the body lax, black, and decomposite; the webs on each side equal; quill and tail feathers snowy, waved, and long, with a sprinkling of black on the edge or tip; chest callous; wing spurs two, one at the end of the wing, and one on the spurious wing; thighs and flanks naked; feet strong, gray-brown; toes connected at the base, the outer very short, and unarmed. The ostrich stands so very high as to measure from seven to nine feet, from the top of the head to the ground; from the back, however, it is seldom more than three or four feet, the rest of its height being made up by its extremely long neck. In the sandy and burning deserts of Africa and Asia, the black ostriches are seen in such large flocks, as sometimes to have been mistaken for distant cavalry. Their strong jointed legs, and cloven hoofs, if we may use the expression, are well adapted both for speed and defence. Their wings and all their feathers are insufficient to raise them from the ground. Their voise is a kind of hollow mournful lowing; and they graze on the plain with the quacha and the zebra. In the interior parts of southern Africa they frequently make great havock in the corn fields, destroying the ears of wheat so effectually, that in a large tract of land, it often happens that nothing but the bare straw is left behind. In running, they have a proud and haughty look, and even when closely pursued, never appear to be in great haste, especially when the wind is with them, and they can easily accelerate their progress by flapping their wings, so as to outstrip the swiftest horse. But if the weather be hot and calm, or if the birds have by any accident lost a wing, the difficulty of outrunning them is not so great. The ostrich is one of the few polygamous birds found in a state of nature, one male being generally seen with two or three, and frequently with five females. It has been commonly believed that the female, after depositing her eggs in the sand, and covering them up, allows them to be hatched by the heat of the climate, and leaves the young to shift for themselves. Recent travellers have, however, assured us, that no bird whatever has a stronger affection for her offspring, and that none watches her eggs with greater assiduity. It is true, that during the intense heat of the day, when incubation is less necessary, she sometimes forsakes them, but she always carefully broods over them by night. Kolben affirms that this species sit on their eggs like other birds, and that the males and females take this office by turns, as he had frequent opportunities of observing. Nor is it more true, that they forsake their young as soon as excluded from the shell. On the contrary, the old ones are very assiduous in supplying them with grass and water, are careful to defend them from harm, and will even themselves encounter every danger in their defence. All the females which are attached to one male, deposit their eggs in the same place, to the number of ten or twelve each, about the size of a child's head. These they hatch all together, the male also taking his turn of sitting on them. Thus from sixty to seventy eggs have sometimes been found in one nest, and Linnæus erroneously assigned them to one female. The term of incubation is six weeks. The nest appears to be merely a hole in the ground, formed by the birds trampling the earth for some time with their feet. If the eggs are touched by any person in the absence of the parents, they immediately discover it by the scent, at their return, and not only desist from laying any more in the same place, but trample to pieces with their feet all those that have been left. On this account the Africans are very careful in taking part of the eggs away not to touch any of them with their hands, but always fetch them out of the nest with a long stick. Within the eggs are frequently discovered a number of small oval-shaped pebbles, of the size of a marrowfat pea, of a pale yellow colour, and exceedingly hard. These eggs are reckoned a great delicacy, and are prepared in various ways. From their large size, one of them is sufficient to serve two or three persons at a meal. The ostrich itself is chiefly valuable for its plumage; and the Arabs have reduced the chase of it to a kind of science. They hunt it,

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it, we are told, on horseback, and begin their pursuit at a gentle gallop; for should they, at the outset, use the least rashness, the matchless speed of the game would immediately carry it out of their sight, and in a very short time, beyond their reach. But when they proceed gradually, it makes no particular effort to escape. As it does not go in a direct line, but runs first on one side, and then on the other, its pursuers save much ground by rushing directly onward. In a few days at most, the strength of the animal is exhausted, and it then either turns on the hunters, and fights with the fury of despair, or hides its head, and tamely receives its fate. Frequently, also, the natives conceal themselves in ostrich skins, and thus are enabled to approach near enough to surprise them. Some persons breed up these birds in flocks, for they are tamed with very little trouble, and may be rendered very useful in a domestic state. Besides the valuable feathers which they cast, the eggs which they lay, their skins, which are used by the Arabians as a substitute for leather, and their flesh, which many esteem excellent food, they are sometimes made to serve in place of horses. It is pleasant to observe with what dexterity they play and frisk about in a tame state, particularly in the heat of the day, when they will strut along the sunny side of a house, with great majesty, perpetually fanning themselves with their expanded wings, and seeming, at every turn, to admire and be enamoured of their own shadows. They are very tractable and familiar towards persons who are acquainted with them, but are often fierce towards strangers, whom they frequently attempt to push down by running furiously on them, and when they succeed thus far, they not only peck at their fallen foe with their bill, but strike at him violently with their feet. While thus engaged, they sometimes make a fierce hissing noise, and have their throat inflated, and mouth open; and at other times, make a kind of cackling noise. During the night they often utter a doleful or hideous cry, somewhat resembling the distant roaring of a lion, or the hoarse tone of a bear or an ox, as if they were in great agony. They will swallow with the utmost voracity rags, leather, wood, iron, or stone, indiscriminately. "I saw one at Oran (says Dr Shaw), that swallowed, without any seeming uneasiness or inconvenience, several leaden bullets, as they were thrown upon the floor, scorching hot from the mould." Mr Adanson mentions two ostriches which afforded him a sight of a very extraordinary nature. They were so tame, that two little blacks mounted both together on the back of the largest. No sooner did he feel their weight, than he began to run as fast as possible, and carried them several times round the village, as it was impossible to stop him otherwise than by obstructing the passage. To try their strength, he directed a full-grown negro to mount the smallest, and two others the largest. This burthen did not seem at all disproportioned to their strength. At first they went at a pretty sharp trott, but when they became heated a little, they expanded their wings, as if to catch the wind, and moved with such fleetness that they scarcely seemed to touch the ground. "Most people (observes M. Adanson) have, one time or other, seen a partridge run, and consequently must know that there is no man whatever able to keep up with it: and it is easy to imagine, that if this bird had a longer step, its speed would be considerably augmented. The ostrich moves like the partridge, with this advantage; and I am satisfied that those I am speaking of would have distanced the fleetest race horses that were ever bred in England. It is true, they would not hold out so long as a horse, but they would undoubtedly be able to go over the space in less time. I have frequently beheld this sight, which is capable of giving one an idea of the prodigious strength of an ostrich, and of showing what use it might be of, had we but the method of breaking and managing it as we do a horse."

Emeu, or *cassowary*.—Feet three-toed; helmet and dewlaps naked; bill and legs black; gape very large; irides topaz; eyelids fringed; nostrils nearly at the tip of the bill; eyes large; helmet horny, reaching from the base of the bill to the middle of the crown, three inches high, the fore part blackish, the hind part yellow; temples and neck bald, wrinkled, and reddish, with a blue or purple tinge, and covered with a few scattered hairs; two pendant caruncles, partly red and partly blue, on each side of the neck; chest on which it rests callous; feathers brownish-black, lax, generally two from one shaft; no tail; wings consisting of about five naked dusky shafts; claws straight. Five feet and a half long. Inhabits within the torrid zone in Asia; is a fierce and bold bird; kicks with its feet like a horse, grunts like a hog, feeds on vegetables, which it swallows whole; lays greenish eggs, more oblong than those of the black ostrich; runs very swiftly, and is incapable of flying. 642 *Casuarius.*

New Holland cassowary.—Feet three-toed, crown flat; shanks serrated behind. Seven feet two inches long. Inhabits New Holland. 643 *Novæ Hollandiæ.*

American ostrich.—Feet three-toed, and a round callus behind. Nearly the height of a man. Inhabits South America; feeds on fruits, flesh, and flies, defends itself with its feet, and calls its young by a kind of hiss. 644 *Rhea.*

Gen. 67. DIDUS, *Dodo*. 645 DIDUS.

Bill narrowed in the middle, with two transverse wrinkles; each mandible bent in at the tip; nostrils oblique, near the edge of the middle of the bill; face naked beyond the eyes; legs short and thick; feet cleft; wings unfit for flight; no tail. 646 Characters.

Hooded dodo.—Black, waved with whitish; head hooded; feet four-toed; bill strong, large, bluish, with a red spot; the upper mandible yellowish at the tip, the lower bulging near the tip; gape very large; irides whitish; plumage soft; belly whitish; head large, black, as if covered with a cap; feathers of the rump curled, inclining to yellow; legs yellowish; claws wanting. This uncouth species is rather bigger than a swan, and nearly three feet in length. It inhabits the islands of Mauritius and Bourbon in the Indian ocean. According to Helbert, it seldom weighs less than 50 pounds; has a slow pace; the body round and fat: and the stomach so strong as to digest stones. It is, however, so seldom met with that its true history is little known. 647 *Ineptus.*

Solitary dodo.—Varied with gray and brown; feet four-toed; eyes black; spurious wings, terminating in a round protuberance. The female with a white protuberance, resembling a teat, on each side of the breast. Size of a turkey. Inhabits the island of Rodrigue, where it is not uncommon, though seldom more than 648 *Solitarius.*

Gallinæ. two are found together. It makes its nest in by-places, of leaves of the palm, a foot and a half in thickness, and lays one egg, bigger than that of a goose. The male sits in his turn, and does not suffer any bird to approach within two hundred yards of the spot when the hen is sitting. The incubation lasts seven weeks. Some months elapse before the young can shift for itself. The old ones in the mean time treat it with affection and tenderness, and are faithful to each other afterwards, though they may occasionally mix with others of their kind. The young bird, though timid, is stupid enough to allow a person to approach it; but when grown up, it is more shy, and will not be tamed. They are chased in the winter season, viz. from March to September, being then fat, and the young birds are much esteemed for the table.

649 Pavo.

Gen. 68. Pavo, *Peacock*.

650 Characters. Bill convex and strong; head with a crest of feathers turning forwards; nostrils large; rump feathers long, broad, expansile, and covered with eye-like spots.

651 *Christatus.* *Crested peacock.*—Head with a compressed crest; spurs solitary. It is impossible to describe the beauties of this well-known species in adequate terms. Its matchless plumage, as Buffon observes, seems to combine all that delights the eye in the soft and delicate tints of the finest flowers, all that dazzles it in the sparking lustre of the gems, and all that astonishes it in the grand display of the rainbow. Its head is adorned with a tuft, consisting of 24 feathers, whose slender shafts are furnished with webs only at the ends, painted with the most exquisite green, mixed with gold. The head, throat, neck, and breast, are of a deep blue, glossed with green and gold; the back of the same, tinged with bronze; the scapulars and lesser wing-coverts are of a reddish cream-colour, variegated with black; the middle coverts deep blue, glossed with green and gold; the greater coverts and spurious wing are of a reddish-brown, as are also the quills, some of which are variegated with black and green; the belly and vent are black, with a greenish line. But the distinguishing character of this bird is its train, which rises just above the tail, and when erected, forms a fan of the most resplendent hues. The two middle feathers are sometimes four feet and a half long, the others gradually diminishing on each side. The shafts, which are white, are furnished from their origin nearly to the end with parted filaments of varying colours, ending in a flat valve, which is decorated with what is called the *eye*. This is a brilliant spot, enamelled with the most enchanting colours, yellow, gilded with various shades, green, running into blue and bright violet, varying according to its different positions, the whole receiving additional lustre from the centre, which is a fine velvet black. When pleased or delighted, and in sight of his females, the peacock erects his tail, and displays all the majesty of his beauty, and he frequently turns slowly round, as if to catch the sunbeams in every direction, accompanied with a hollow murmuring voice. His cry at other times is very disagreeable, and often repeated. The peahen is somewhat less than the cock, and though furnished both with a train and crest, is destitute of those dazzling beauties which distinguish the male. She lays five or six eggs of a whitish colour, in some secret spot, where she can conceal them from the male, who is apt to break them; and she sits from 25 to 30 days, according to the temperature of the climate and the warmth of the season. Peacocks were originally brought from the distant provinces of India, and thence have been diffused over every part of the world. They are sometimes found in a wild state in many parts of Asia and Africa. The largest and finest are said to be met with in the neighbourhood of the Ganges, and on the fertile plains of India, where they grow to a great size. In colder climates, they require care in rearing; and do not acquire their full plumage till their third year. In former times they were considered as a delicacy, and made a part of the luxurious entertainment of the Roman voluptuaries. The females of this species, like the pheasant, have been known to assume the appearance of the male, by a total change of colour, which is said to take place, after they have done laying. A white variety of peacock occurs not unfrequently, in which the eyes of the train are barely visible, and may be traced by a different undulation of shade on the pure white of the tail. 652

Bicalcaratus. *Iris peacock.*—Brown; head subcrested; spurs two; bill blackish; the upper mandible, from the nostrils to the tip, red; irides yellow; crown black; face naked; temples white: neck shining brown, with black lines; upper part of the back, shoulders, and wing-coverts brown, with yellowish stripes; the feathers near the tip with a large purple gold spot; lower part of the back and rump spotted with white; body brown beneath, with transverse black streaks; quill feathers dusky; legs brown. Larger than a pheasant. Inhabits China.

Gen. 69. Meleagris, *Turkey*. 653 Meleagris.

Bill conical, and incurved; head covered with spongy caruncles; chin with a longitudinal membranaceous caruncle; tail broad, and expansile; legs spurred.

American or *common turkey*.—Front and chin carunculated; breast of the male tufted. Female without a spur. Upwards of three feet and a half long. Inhabits America; and is very generally domesticated. In a wild state it lives in woods, and feeds on nuts, acorns, and insects. It roosts on the highest trees; is very irascible, and impatient of any thing red. The cock struts with an inflated breast, expanded tail, red face, and relaxed frontal caruncle, making a singular inward noise, which when it is uttered shakes the whole body. The eggs are numerous and white, with reddish or yellow spots. The females lay them in spring, generally in some retired or obscure place; for the cock, enraged at the loss of his mate while she is employed in hatching, is otherwise apt to break them. They sit on their eggs with so much perseverance, that if not taken away, they will almost perish with hunger before they will entirely leave the nest. In a wild state, turkeys are gregarious, and associate in flocks, sometimes of about five hundred. They are very swift runners, but fly awkwardly; and about the month of March they become so fat, that they cannot fly beyond three or four hundred yards, and are then easily run down by a horseman. The hunting of these birds forms one of the principal diversions of the Canadians. When the latter have discovered the retreats of the turkey, which in general are near fields of nettles, or where there is plenty of any kind of grain, they send a well-trained dog in the midst of the flock. 654 Gallipavo.

The

The birds no sooner perceive their enemy than they run off at full speed, and with such swiftness that they leave the dog far behind; he, however, follows, and as they cannot go at this rate for any length of time, at last forces them to take shelter in a tree, where they sit, spent and fatigued, till the hunters come up, and with long poles, knock them down one after another. Turkey cocks, among themselves, are very fierce and pugnacious, and yet, against other animals, are usually weak and cowardly. The disposition of the female is in general much more mild and gentle than that of the male; and when leading out her young family to collect their food, though so large and apparently so powerful a bird, she gives them very little protection against any rapacious animal that comes in her way, but rather warns them to shift for themselves. It deserves to be remarked, that though this species is reared with some difficulty, yet in its wild state it is found in great plenty in the forests of Canada, that are covered with snow for more than three-fourths of the year. It is easily hurt by hunger or rain. They are bred in great numbers in Norfolk, Suffolk, and some other counties, from whence they are driven to the London markets in flocks of several hundreds. The drivers manage them with great facility, by means of a bit of red rag tied to the end of a long stick, which, from the antipathy that these birds bear to that colour, effectually answers the purposes of a scourge. We need scarcely notice, that the flesh of the turkey is reckoned a delicate food. The Indians make an elegant clothing of the feathers, by twisting the inner webs into a strong double string with hemp, or the inner bark of the mulberry-tree, and working it like matting, so that the whole appears rich and glossy, and as fine as silk shag. The natives of Louisiana make fans of the tail; and of four tails joined together the French used formerly to form a parasol.

655 *Satyra.* *Horned turkey.*—Head with two horns: body red, with eye like spots; bill brown; nostrils, front, and area of the eyes covered with black hair-like feathers; crown red; horns callous, blue, bent back; caruncle of the chin dilatable, blue, varied with rufous; legs whitish, spurred; tail feathers twenty. The female has the head covered with feathers, without horns or gular caruncle; feathers of the head and upper part of the neck black-blue, long, and decumbent; rest of the body, as in the male, red with eye-like spots; spurs more obtuse. Rather less than the preceding. Inhabits India.

656 PENELOPE.

Gen. 70. Penelope.

657 Characters. Bill naked at the base; head covered with feathers; chin naked; tail with twelve feathers; legs without spurs.

658 *Cristata.* *Guan.*—Head with an erect crest; temples violet. Two feet six inches long. Inhabits Brazil and Guiana, where it is frequently tamed, its flesh being reckoned very delicate. It frequently utters a sound like the word *jacu.*

659 *Cumanensis.* *Jacu* or *yacou.*—Blackish; crest and first quill feathers white. Size of a hen turkey. Inhabits Cayenne and Guiana. It erects its crest, expands its tail, and cries in a mournful tone, like a young turkey. It builds on the ground, is easily tamed, and is often domesticated.

660 *Marail.* *Marail turkey.*—Greenish-black; naked orbits; and legs red; throat somewhat naked, speckled with white. Size of a common fowl, and not dissimilar in shape. Though not much known to naturalists, it is common in the woods of Guiana, at a distance from the sea. It is generally seen in small flocks, excepting at breeding-time, when it is only met with in pairs, and then frequently on the ground, or on low shrubs, at other times on high trees, on which it roosts during the night. The female makes her nest on some low bushy tree, as near the trunk as possible, and lays three or four eggs. When the young have been hatched for ten or twelve days, they descend with the mother, which scratches on the ground like a hen, and broods them, till they can shift for themselves. They breed twice a year. The young birds are easily tamed, and seldom forsake the places where they have been brought up. Their cry is not unharmonious, unless they be irritated or wounded, when it is harsh and loud. Their flesh is much esteemed.

661 CRAX.

Gen. 71. Crax, *Curassow.*

662 Characters. **Bill strong and thick; the base of each mandible covered with a cere; nostrils in the middle of the cere; feathers covering the head, turned spirally forward; tail large, straight, and expansile.**

663 *Alector.* Plate CCCC. fig. 4. *Crested curassow.*—(Male). Cere yellow; body black; belly white; bill black or horny; cere reaching from the middle of the bill behind the eyes; crest erect, black, and three inches long; tail black and roundish, eleven inches long, feathers fourteen; spurs none. (Female). Red; head bluish; crest white, tipt with black; bill cinereous; irides red; legs brown. Subject to much variety. Three feet long. Inhabits the mountainous woods of South America. Lives on fruits, roosts on trees, and is often domesticated on account of its white and delicate flesh. They are frequently kept tame in our menageries, and readily mix with other poultry, feeding on bread and grain, but they are unable to bear the dampness of the grass of our meadows, which renders their toes subject to rot off. Dr Latham mentions an instance in which the whole of one foot was gone, and but part of one toe left on the other, before the creature died.

664 *Globicera.* *Globose curassow*, or *curassow bird.*—Yellow; gibbosity of the nostrils globular; body blackish-blue, lower part of the belly white; bill yellow, tipt with cinereous; gibbosity yellow, and very hard; irides red; orbits white; crest black, tipt with white; legs pale rusty. (Female). Bill and legs cinereous; head and crown black; crest black, with a white band; some of the feathers of the neck tipt with white; throat, breast, back, and wings brown; upper part of the belly white, and some of the feathers tipt with black; vent yellowish brown; tail black, with four transverse white bands. Size of the preceding. Inhabits Guiana.

665 PHASIANUS.

Gen 72. Phasianus, *Pheasant.*

Bill short and strong; cheeks covered with a smooth naked skin; legs generally with spurs.

666 Characters. The females produce many young ones at a brood, and take care of them for some time, leading them abroad, and pointing out food for them. The young are at first clad with a thick soft down. The nests of the whole tribe are formed on the ground.

667 Gallus. *Common cock*, or *wild cock*.—Comb on the crown, and two wattles on the chin compressed; ears naked; tail compressed and erected; feathers of the neck linear, long, and membranaceous at the tips; body, when wild, less than the common cock; comb large, indented, shining-red; temples and line from the crest to the eyes naked and flesh-coloured, a clay-coloured spot of the shape of a man's nail, and covered with short feathers, behind the eyes; feathers of the rest of the head and neck long, narrow, gray at the base, black in the middle, and tipt with white; feathers of the upper part of the body grayish, with a white and a black streak; breast reddish; greater wing-coverts reddish-chesnut, with transverse black and white streaks; tail coverts glossy violet; middle tail feathers long and falcated; spurs large and curved. The female without comb and wattles; head and neck gray; cheeks and chin whitish; body more dusky, and varied with brown gray and rufous; and wants the spurs. Inhabits India in a wild state, is every where domesticated, and subject to innumerable varieties in size and colour. His beautiful plumage and undaunted spirit, as well as his great utility, have rendered him a favourite in all countries into which he has been introduced. The cock is very attentive to his females, hardly ever losing sight of them. He leads, defends, and cherishes them, collects them together when they straggle, and seems to eat unwillingly till he sees them feeding around him. Whenever a strange cock appears within his domain, he immediately attacks the intruder, and, if possible, drives him away. The patience and perseverance of the hen in the hatching, are truly extraordinary, but are too familiar to most of our readers to require to be detailed. Though by nature timid, and apt to fly from the meanest assailant, yet, when marching at the head of her brood, she is fearless of danger, and will fly in the face of the fiercest animal that offers to annoy her. As the chickens reared by the hen bear no proportion to the number of eggs which she produces, many artificial schemes of rearing have been attempted. Chickens have long been hatched in Egypt by means of artificial heat. This is now chiefly practised by the inhabitants of a village called Berme, and by those who live at a little distance from it. Towards the beginning of autumn, these persons spread themselves all over the country, and each of them is ready to undertake the management of an oven. These ovens are of different sizes, each capable of containing from forty to eighty thousand eggs; and the number of ovens in different parts is about three hundred and eighty-six. They are usually kept in exercise for about six months; and as each brood takes up twenty-one days in hatching, it is easy in every one of them to produce eight different broods of chickens in the year. The ovens consist only of a low arched apartment of clay. Two rows of shelves are formed; and the eggs are placed on them in such a manner as not to touch each other. They are slightly moved five or six times in the course of twenty-four hours. All possible care is taken to diffuse the heat equally throughout, and there is but one aperture, just large enough to admit a man stooping. During the first eight days, the heat is rendered great, but during the last eight it is gradually diminished, till at length, when the young brood are ready to come forth, it is reduced almost to the state of the natural atmosphere. Every keeper of an oven obliges himself to deliver to his employer only two thirds of as many chickens as there have been eggs entrusted to him; and he is a gainer by this bargain, as it always happens, except from some unlucky accident, that many more than that proportion of the eggs are productive. In this way it has been calculated that the Egyptian ovens give life annually to near a hundred millions of chickens. This useful and advantageous mode of hatching eggs was introduced into France by the ingenious and indefatigable Monsieur de Reaumur, who, by a number of experiments, reduced the art to certain principles, and applied it to the production of all kinds of domestic fowls. The young brood are generally hatched a whole day before they taste food, and then a few crumbs of bread are given for a day or two, after which time they begin to pick up grain and insects for themselves. In order to save the trouble of attending them, capons are taught to watch them in the same manner as hens. M. de Reaumur informs us, that he has seen above two hundred chickens at once, all led about and defended by only three or four capons. It is asserted that even cocks may be taught to perform this office, which they will continue to do all their lives afterwards. Among the endless varieties of this species, the English game cock stands unrivalled by those of any other nation for its invincible courage, and on that account is made use of as the instrument of the inhuman sport of cock-fighting. The Athenians allotted one day in the year to this barbarous pastime; and the Romans are said to have learned it from them, and to have introduced it into this island. Henry VIII. was so fond of the sport, that he caused a commodious house to be erected for that purpose, which, though now applied to a very different use, still retains the name of the *cock-pit*. The Chinese, the Sumatrians, and others in the eastern parts of the world, are so addicted to this savage diversion, that, in the paroxysms of their frenzy, they will sometimes risk not only the whole of their property, but their wives and children, on the issue of a battle. The cock, it is well known, is a watchful bird, and crows clapping his wings. The hen will lay eggs the whole year, provided she has plenty of food and cold water, gravel, and a warm place. After laying she has a peculiar note of triumph and exultation. Her heat is increased while hatching, but if put into cold water, she ceases to sit. 668

Courier pheasant.—Tawney white; tail long, and shining green; a few white spots at the base of the tail. Eighteen inches long. Inhabits New Spain; is slow in flight, but so swift on foot as to outrun the fleetest horses. Mexicanus. 669

Common pheasant.—Rufous, head blue; tail wedged; cheeks papillous; bill pale, horn colour; irides yellow; cheeks red, speckled with black; in the old birds wrinkled and pendulous; a greenish-black feathered line from the nostrils to beneath the eyes; rest of the head and neck green-gold, with a gloss of violet and blue; lower part of the neck, breast, back, and rump, shining tawney; quill feathers brown, with ochreous spots; belly and vent white; tail feathers eighteen, with transverse black bars; legs dusky, armed with spurs. Female less, varied with brown, gray, rufous, and blackish; cheeks feathered; and, after she has done breeding, puts on the appearance of the male. There are several varieties. This beautiful bird is about nineteen inches long, and weighs from two pounds twelve ounces to three pounds four ounces. It is said to have been brought from the island of Colchis Colchicus.

Gallinæ. chis by the Argonauts; is a native of Africa, and very common in almost all the southern parts of the old continent, whence it was originally imported into Great Britain. Pheasants are much attached to the shelter of thickets and woods, where the grass is very long; but they also often breed in clover fields. They form their nests on the ground, and the females lay from twelve to fifteen eggs, which are smaller than those of the domestic hen. The nest is usually composed of a few dry vegetables put carelessly together, and the young follow the mother like chickens, as soon as they break the shell. The parents and their brood remain in the stubble and hedge rows, if undisturbed, for some time after the corn is ripe. If disturbed, they seek the woods, and only come forth in the mornings and evenings to feed in the stubble. Though very fond of corn, they are often obliged to content themselves with wild berries and acorns. In confinement, the female neither lays so many eggs, nor hatches and rears her brood with so much care and vigilance as in the fields. In a mew she will very rarely dispose her eggs in a nest, or sit on them at all; and the domestic hen is usually entrusted with the charge of incubation and rearing the young. The wings of the pheasant are very short, and ill adapted for considerable flights. As the cold weather approaches, these birds begin to fly at sunset among the branches of oak trees for roosting during the night; and this they do more frequently as the winter advances, and the trees lose their foliage. The male birds at these times make a noise, which they repeat three or four times, and which the sportsmen call *coketing*. The hens on flying up utter one shrill whistle, and then are silent. Poachers avail themselves of these notes, and, unless the woods are strictly watched, secure the birds with the greatest certainty. The crowing of the males, which begins in the first week of March, may be heard at a considerable distance. During the breeding season, the cocks will sometimes intermix with the common hen, and produce a hybrid breed. The pheasant does not appear to pair, for the female carefully hides her nest from the male; and where they are in plenty, and food provided for them, the two sexes are said in general not to feed together. In a domestic state, they are sometimes more or less mixed with white, and sometimes wholly so. A variety with a white ring round the neck, and thence called the *ring pheasant*, is not uncommon in some parts of England. This species rarely occurs in Scotland.

670 *Argus.* *Argus pheasant*.—Pale yellow, spotted with black; face red; hind head crested, blue; bill yellowish; orbits and whiskers black; front, chin, and throat red; hindhead and nape blue; wings gray, with eye-like spots; tail wedged, the colour of the wings; two middle feathers three feet long, with large eye-spots at the shaft; feet armed; size of a turkey. Inhabits Chinese Tartary and Sumatra. This is a most beautiful bird, though its colours are not brilliant. It is with great difficulty kept alive for any time after it has been caught in the woods. It seems to have an antipathy to the light, being quite inanimate in the open day; but when kept in a dark place, it appears to be perfectly at ease, and sometimes makes its call, which is rather planitive, and not harsh like that of the peacock. The flesh resembles that of the common pheasant.

671 *Impeyanus.* *Impeyan pheasant*.—Crested, purple glossy green, black beneath; feathers of the neck with a changeable lustre of gold, copper, and green; tail entire, rufous; larger than a common fowl. Inhabits India, but not plentifully, being brought from the hills in the northern parts of Hindostan to Calcutta, as curiosities. Lady Impey attempted, with great probability of success, to bring over with her some of them to England; but after living in health on board the ship for two months, they caught a disorder from the rest of the poultry, similar to the smallpox, and died in consequence. They bear cold, but are impatient of heat. The cock was never observed to crow, but had a strong hoarse cackle, not unlike that of a pheasant.—Described and figured by Latham.

672 *Cristatus.* Plate CCCC. fig. 3. *Crested pheasant*.—Brown above; beneath reddish-white; vent rufous; head crested; orbits red, naked; tail wedge-shaped, and tipt with yellow; bill and unarmed legs black; feathers of the crest whitish-brown; beneath black; feathers from the hind head to the lower part of the neck have a white streak down the middle; coverts of the wings at the tip and edge white; quill feathers rufous; tail ten inches long; length of the body 22 inches. Native of New Spain. Frequents trees in the neighbourhood of water, and feeds on worms, insects, and serpents.

673 *Pictus.* *Painted pheasant*.—Crest yellow; breast scarlet; secondary quill feathers blue; tail wedged; bill, irides, and armed legs, yellow; feathers of the crest silky, and hanging backwards; cheeks naked and flesh coloured; feathers of the hind head tawney, with black lines, and beneath these green ones; back and rump yellow; upper tail coverts long, narrow, and scarlet; wing-coverts varied with bay and brown; scapulars blue; quill feathers brown, with yellowish spots; tail feathers varied bay and black, and 23 inches long. Female reddish brown; yellowish brown beneath; legs unarmed; less than the common pheasants; length two feet nine inches and a half. The native country of this beautiful species is China, where it is called *Kin-ki*. It bears confinement well, and will breed readily in that state. The eggs are redder than those of the common pheasant, and somewhat resemble those of the Guinea fowl. An instance of their breeding with the common pheasant is mentioned by Buffon. Edwards informs us, that some females of this species, kept by Lady Essex, in the space of six years gradually gained the male feathers; and we are told, that it is not unusual for the hen birds, when about four or five years old, to be neglected by the cocks, and gradually to gain the plumage of the males.

674 *Superbus.* *Superb pheasant*.—Unarmed; rufous, varied with green and blue; caruncles of the front rounded; wattles awl-shaped; bill and body red; each side of the neck with long feathers turned back; crown green; the hind part with a folding blue crest; shoulders green, spotted with white; primary quill feathers blue; tail long, wedged, the feathers varied with blue and red; coverts declined, and of various mixed colours; legs yellow. Inhabits China.

Gen. 73. NUMIDA, *Pintado*, or *Guinea Fowl*. 675 NUMIDA.

676 Characters. Bill strong and short; the base covered with a caruncculated cere, receiving the nostrils; head horned, with a compressed coloured callus; tail short, bending down; body speckled.

Common

Gallinæ.

677 *Meleagris.* *Common Guinea hen.*—Caruncles at the gape double, and no gular fold; bill of a reddish horn colour; head blue; the crown with a conical, compressed, bluish red protuberance; upper part of the neck bluish ash, almost naked; lower feathered, verging to violet; body black, with round white spots; legs gray brown; gular caruncle of the male bluish; of the female red. There is a variety with the breast white, and another with the body entirely white; somewhat larger than the common hen. Inhabits Africa, and is domesticated in most parts of Europe, the West Indies, and America. It formed a part of the Roman banquets, and is now much esteemed as a delicacy, especially when young. The female lays a great number of eggs, which she frequently secretes till she has produced her young brood. The eggs are smaller than those of a common hen, and of a rounder shape, and are delicious eating. The Guinea hen is a restless and very clamorous bird, and has a harsh creaking note, which is peculiarly grating and unpleasant. Like the common domestic fowl it scrapes the ground, and rolls in the dust to free itself from insects. During the night it perches on high places, and, if disturbed, alarms the neighbourhood by its unceasing cry. In its natural state of freedom, it is said to prefer marshy places. It is easily tamed, but often abandons its young.

678 TETRAO.

Gen. 74. TETRAO.

679 Characters. Near the eyes, a spot which is either naked or papillous, or rarely covered with feathers.

The birds of this genus have a strong convex bill; grouse, partridges, and quails, agree in having a short convex bill. The grouse chiefly inhabits the colder regions, and is distinguished by small nostrils, hid under the feathers; an acute tongue; strong feet; and a pretty long tail. Partridges and quails are less in size; have a short tail; and their nostrils covered above with a callous prominent margin. They inhabit the temperate and even the warmer climates. The tinamous are a tribe peculiar to Guiana, and approach the pheasant in manners. Their bill is longer and obtuse at the apex; the nostrils are placed in the middle; their gape is very wide; the throat thinly covered with feathers; the tail very short; the back-toe short, and useless for running. The female is larger than the male.

680 *Grouse.* A. *Spot over the eyes naked; legs downy.* *Grouse.*

681 *Urogallus.* *Wood grouse, cock of the wood*, or *capercailzie.*—Tail rounded; arm-pits white; bill horn colour; spot above the eyes scarlet; irides hazel; nostrils covered with short feathers; feathers of the chin black, longer; head and neck cinereous, with fine transverse black lines; body bay with blackish lines above; breast blackish green; belly and vent black, varied with white; tail feathers 18, each side spotted with white; legs robust and brown; toes pectinated at the edge. Of the female the bill is dusky; chin red; body with alternate red and black transverse lines above; breast with a few white spots, the lower part orange; belly spotted with pale orange and black, the feathers tipt with white; shoulders black, the feathers edged with black and pale tawney, and tipt with white; tail rusty, barred with black, and tipt with white. In size, this species is little inferior to a turkey, and sometimes weighs 12 or 13, but more frequently seven or eight pounds. The male is two feet nine inches, and the female two feet two inches long. Inhabits the mountainous and woody parts of Europe and northern Asia. It is not uncommon in the pine-forests of Normandy, in Russia and Siberia, in Italy, and several parts of the Alps. In Scotland and Ireland it is nearly extinct. It feeds on the berries of the juniper and vaccinium, and on the seeds of the pine tribe and other trees. It is a solitary bird, except in the season of love, when, in the beginning of February, perched on the top of a tree, it calls the females about it with a loud voice, its tail expanded, its wings hanging down to its feet, its neck stretched out, and the feathers of its head erected. The female builds on the ground among mosses, and lays from eight to sixteen eggs. The flesh of this species is much esteemed, and its eggs are accounted preferable to those of every other bird. They are white, spotted with yellow, and larger than those of the common hen. The young follow the hen as soon as they are hatched, and sometimes with part of the shell attached to them.

Black game, black grouse, or *black cock.*—Violet 682 *Tetrix.*
black; tail forked; secondary quill feathers white towards the base; bill black; body shining glaucous-black; wing-coverts black brown; four first quill feathers black, the rest white at the base; tail feathers from 16 to 18, black; legs black brown; toes pectinated. Female less; the weight of an old cock is nearly four pounds, but that of the female is not often more than two. Length about 23 inches: there are several varieties. Inhabits mountainous and woody parts of Europe. In Britain it is chiefly confined to the northern parts of the kingdom, and especially to the Highlands of Scotland; population and culture having driven them from the south, except in a few of the more wild uncultivated parts, as in the New Forest in Hampshire, Dartmoor and Sedgemoor in Devonshire, and the heathy hills in Somersetshire contiguous to the latter. It also occurs in Staffordshire, North Wales, and the north of England. It feeds principally on the tops of heath and birch, except when the mountain berries are ripe, at which time it devours bilberries and craneberries with the greatest voracity. In the month of April the male places himself on an eminence, at morning dawn, and invites the females by crowing and clapping his wings. The males are polygamous, and fight desperately for the females. They afterwards associate peaceably in small packs, are fond of wood, heathy, and mountainous situations; but occasionally visit the corn fields in autumn, retiring wholly to woods in the winter, and perching on trees. It is somewhat remarkable that they are killed by eating cherries or pears. The female forms an artless nest on the ground, and lays six or eight eggs, of a dull yellowish white colour, marked with numerous very small ferruginous specks, and with blotches of the same towards the smaller end. The young are hatched very late in summer. The young males quit their parent in the beginning of winter, and keep together in flocks of seven or eight till the spring. They do not acquire their male garb till towards the end of autumn, when the plumage gradually changes to a deeper colour, and assumes that of a bluish-black, which it afterwards retains.

Ptarmigan, white grouse, or *white game.*—Cinereous; 683 *Lagopus.*
toes downy; quill feathers white; tail feathers black, tipt

Gallinæ. tipt with white, the middle ones white; body, in summer, cinereous, varied with white and brown, in winter nearly all white; but in all seasons the lateral tail feathers are black, tipt with white; legs and toes covered with a thick wool like a hare's. From 14 to 15 inches long. Inhabits the Alpine parts of Europe and Siberia. In this country it is met with only on the summits of our highest hills, chiefly in the Highlands of Scotland, and sometimes, but rarely, on the lofty hills of Cumberland and Wales. As the snow melts on the sides of the mountains, it constantly ascends till it gains the summit, where it forms holes, and burrows in the snow. These birds pair at the same time with the red grouse; the female lays eight or ten white eggs, spotted with brown, not in any regular nest but on the ground. In winter they fly in flocks, and are so little accustomed to the sight of man, that they are easily shot, or taken in a snare. They feed on the wild productions of the hills, as the buds of trees, the young shoots of pines, the heath, crow-berry, rhododendron, &c. They run swiftly, fly heavily, are impatient of the sun and wind, and are unsusceptible of domestication. The flesh of the young is accounted a great delicacy. That of the full-grown birds has sometimes a bitter, but not unpalatable taste: it is also dark coloured, and, according to Buffon, approaches in flavour to that of the hare.

684 Albus. *White grouse.*—Orange, varied with black bands and white blotches; toes downy; tail feathers black, tipt with white; the middle ones entirely white; bill black; belly and legs white; claws broad and flat. Upwards of 16 inches long. Inhabits the woods of Europe and Asia, and, like the preceding, grows white in winter.

685 Cupido. *Pinnated grouse.*—Back of the neck with supplemental wings, which are wanting in the female. The male is smaller than a partridge. Inhabits North America; feeds chiefly on acorns; and at sunrise erects his neck and wings, and sings for the space of half an hour.

686 Bonasia. *Hazel grouse.*—Tail feather cinereous, with black spots and a black band, except the two middle ones. Fourteen inches long. Inhabits the hazel woods of Europe; feeds on catkins; when terrified, erects the feathers of the crown.

687 Attagen or Scoticus. *Red grouse*, or *moorcock.*—Transversely streaked with rufous and blackish; six outer tail feathers blackish on each side; caruncle on the eyebrows lunated and scarlet; greater quill-feathers brown; tail feathers sixteen, the four middle ones the colour of the back, the rest blackish. Length fifteen inches; weight about nineteen ounces. This species is only to be met with in the extensive uncultivated wastes that are covered with heath, particularly the most mountainous situations, having been driven from the south by cultivation. It still occurs in the mountains of Wales, and in the moorlands of Yorkshire and the north of England, but is no where so plentiful as in the Highlands of Scotland, and in the waste moors of North Britain in general. It is also found in the Western islands, and in the mountains and bogs of Ireland; but seems to be unknown on the continent of Europe, those mentioned by Buffon as natives of France, Spain, Italy, &c. either forming a distinct species, or at least a variety. Linnæus did not seem to be acquainted with it, and Gmelin gave it as a variety of the ptarmigan. The red grouse never resort to woods, but confine themselves wholly to the open moors, feeding on the mountain and bog berries; and, in defect of these, on the tops of the heath. They pair in the spring; and the female lays from 8 to 14 eggs, much like those of the black grouse, but smaller, on the ground. The young keep with the parent birds till towards winter, and are called a *pack*, or *brood*. In November they flock together in greater numbers, sometimes to the amount of thirty or forty, and are then extremely shy and difficult to be shot. Gallinæ.

B. *Orbits granulated; legs naked.*

a. *Legs of the male armed with a spur. Partridge.* 688 Partridge.

Greek or *red partridge.*—Bill and legs blood-red; 689 Rufus. chin white, surrounded with a black band, and spotted with white; feathers of the sides with a double black stripe; tail feathers fourteen, cinereous, the five outer rufous for the last half. Rather larger than the next species. Inhabits various parts of southern Europe, Asia, Africa, and the Greek islands. A variety, called the *Guernsey* or *red-legged partridge*, has sometimes been found on the Suffolk or Norfolk coasts. It is distinguished by a single black stripe on the feathers of the sides, and sixteen tail feathers, of which the five outer are rufous on each side. The red partridge frequently perches on a tree, and will breed in confinement, which the common one is never known to do.

Common partridge.—A naked scarlet spot under the 690 Perdix. eyes; tail ferruginous; breast brown; legs white; face yellowish; cap and neck waved ash; quill feathers brown, with ferruginous bands; tail feathers eighteen, lower part of the breast with two chesnut spots. Several varieties of this species are enumerated by ornithologists, but most of them appear to be accidental. Length about 13 inches; weight 15 ounces. Inhabits Europe and Asia, though chiefly in temperate regions, the extremes of heat and cold being equally unfavourable to it. They are nowhere in greater plenty than in this island, where, in their season, they contribute to our most elegant entertainments. They haunt corn fields, and are never found at any distance from arable land. They pair early in the spring; and the female is very prolific, laying from 12 to 20 eggs. It makes no nest, but scrapes a small hole in the ground, and throws into it a few contiguous fibres, on which to deposit the eggs. The old birds sit very close on the latter when near hatching. The incubation lasts three weeks, and the young birds learn to run as soon as hatched, frequently with part of the shell sticking to them. It is no uncommon thing to introduce partridges eggs under the common hen, who hatches and rears them as her own: but, in this case, the young birds require to be fed with the larvæ of ants, which are their favourite food, and without which it is almost impossible to rear them. They likewise eat insects, and, when full grown, feed on all kinds of grain and young plants. "The affection of the partridge for her young (says Mr Bewick), is peculiarly strong and lively; she is greatly assisted in the care of rearing them by her mate: they lead them out in common, call them together, point out to them their proper food, and assist them in finding it by scratching the ground with their feet; they frequently sit close by each other, covering the chickens with their wings like the hen. In this situation they are not easily flushed; the sportsman, who is attentive to the preservation of his game, will carefully avoid giving any disturbance to a scene

Gallinæ. scene so truly interesting; but should the pointer come too near, or unfortunately run in upon them, there are few who are ignorant of the confusion that follows: the male first gives the signal of alarm by a peculiar cry of distress, throwing himself at the same moment more immediately into the way of danger, in order to deceive or mislead the enemy; he flies, or rather runs along the ground, hanging his wings, and exhibiting every symptom of debility, whereby the dog is decoyed, in the too eager expectation of an easy prey, to a distance from the covey; the female flies off in a contrary direction, and to a greater distance, but returning soon after by secret ways, she finds her scattered brood closely squatted among the grass, and, collecting them with haste, she leads them from the danger, before the dog has had time to return from his pursuit."

691 *Quail* b. *Legs without a spur. Quail.*

692 *Viridis.* *Green quail.*—Green; bill and legs reddish; wings chesnut, speckled with black; bill a little bent at the tip; hind toe unarmed; tail and vent black. Between 11 and 12 inches long.

693 *Californicus.* *Californian quail.*—Lead colour; crown with an upright crest; throat black, edged with white; belly yellowish brown, with black crescents. The female wants the black throat and whitish margin. Larger than the common quail. Inhabits California.

694 *Suscilator.* *Noisy quail.*—Varied with yellowish, rufous, black, and gray; bill longer than in others of the genus. A very clamorous bird, which inhabits the woods in Java.

695 *Sinensis.* *Chinese quail.*—Body spotted with gray; throat black, with a white arch. From four to six inches long. Inhabits China and the Philippine isles, and is carried alive by the Chinese, in the winter, between their hands, for the purpose of warming them.

696 *Coturnix.* *Common quail.*—Body spotted with gray; eyebrows white; tail feathers with a ferruginous edge and crescent; bill black; head black, varied with rufous; a yellowish streak down the middle of the crown and neck; feathers of the neck rusty brown, varied with gray; the shafts with a longitudinal yellowish streak; body beneath dirty ochreous; throat and breast reddish; quill feathers gray brown, with rufous bars on the outside; tail feathers twelve, with reddish and black lines; legs brownish. Seven inches and a half long. Inhabits Europe, Asia, and Africa. When these birds migrate to and from the north, they are found in prodigious quantities in all the islands of the Archipelago. One hundred thousand, it is said, have been taken in one day on the west coast of the kingdom of Naples. A small portion only extend their flight to this country. With us they appear about the beginning of May, in our cultivated champaign districts, though not in such numbers as formerly. On their first arrival, the males are constantly uttering a whistling note, thrice successively repeated, which being imitated by a whistle or quail-call, they are easily enticed into a net. Before the revolution, great quantities used to be sent alive from France to the London market. In confinement they fatten, and seem to lose much of their fierce and pugnacious disposition. The female deposits eight or ten yellowish eggs, blotched, or spotted with dusky, on the bare ground, and usually with us among green wheat. The young birds follow the mother as soon as hatched, but do not continue long together; for they are scarcely grown up when they separate, or, if kept together, they fight obstinately, and frequently destroy one another. From this quarrelsome disposition it was, that the Greeks and Romans used them as game cocks; and that the Chinese, and some of the Italians are, at this day, addicted to the diversion of quail-fighting. After feeding two quails very highly, they place them opposite to each other, and throw in a few grains of seed between them, when the birds rush on each other with the utmost fury, striking with their bills and heels till one of them yields.

C. *Orbits with a few feathers; legs naked, four-toed, and unarmed. Tinamous.* 697 *Tinamus.*

698 *Guianensis.* *Cayenne tinamous.*—Bill and legs brown; back ashy-brown, varied with blackish stripes; chin cinereous; belly pale orange. Eleven inches long. Inhabits Cayenne and Guiana.

Great tinamous.—Legs yellowish-brown; bill black; crown rufous; body olive; back and tail with black spots. Eighteen inches long. Inhabits the woods of South America; roosts on the lower branches of trees; feeds on worms, insects, seeds and fruits; builds twice a-year, at the root of a large tree, and lays from twelve to fifteen green eggs. 699 *Major.*

Little tinamous.—Bill and legs yellow; head and neck black; body brown above, rufous beneath; chin mixed with white; quill feathers brown. Nine inches long. Inhabits Guiana. Builds an hemispherical nest in the branches of trees. 700 *Soui.*

Order VI. PASSERES. 701 Passeres.

Bill conical, pointed; nostrils oval, pervious, and naked. 702 Characters.

The birds of this order have the feet formed for walking or hopping. They live, some at the time of breeding, and others constantly, in monogamy. Some which feed on the seeds of plants have a short bill, others that live on insects and worms are generally furnished with a longer bill. They nestle on trees, in bushes, in houses, and on the ground. They often build very artificial nests, and feed their young with their bill. This order includes all the singing birds; the males are the songsters. They are for the most part eatable.

Gen. 75. Columba, *Pigeon.* 703 Columba.

Bill straight, descending towards the tip; nostrils oblong, and half covered with a soft tumid membrane. 704 Characters.

The birds of this genus have a weak and slender bill, short feet, and many of them red toes, divided to their origin. They extend their residence even to the arctic regions. They drink much, and not at intervals like other birds, but by continuous draughts like quadrupeds. Their note is plaintive or mournful. They form the connecting link between this and the preceding order; but are more nearly related to the passerine tribes, in being monogamous, in caressing each other by their bills, in the male and female alternately hatching, in both joining to feed the young, in laying but few eggs, and in their nidification. Of upwards of seventy species which belong to this genus, only five or six are natives of of Great Britain. The eggs of all the species are white.

A. *Tail even and moderate.*

705 *Oenas.* *Common* or *stock pigeon*, or *stock dove*.—Bluish; neck above glossy green; double band on the wings, and tip of the tail blackish; throat and breast claret colour; claws black. Length 13 or 14 inches; weight 11 ounces. Inhabits Europe and Siberia; is wild in many places, but is kept in pigeon-houses every where, and is the parent stock whence all the varieties of the domestic pigeon are derived, and is on that account called the *stock-dove*. It build in towers, in caverns of rocks, and in cliffs in unfrequented islands. On the approach of winter, it migrates southward. It is gregarious; lays two eggs, and breeds several times in the year.

706 *Domestica.* *Domestic pigeon*.—Cinereous; rump white; band on the wings, and tip of the tail blackish. The varieties are, however, very numerous, and not easily reducible to distinct descriptions. Some of the more remarkable are, the *rock*, *Roman*, *Barbary*, *jacobine*, *shaker*, *tumbler*, *carrier*, *horseman*, and *turner* pigeons. From 14 to 15 inches long. Inhabits and is domesticated in almost every part of Europe and Asia, and lays from nine to 11 times a year. Though only two eggs are laid at a time, at the expiration of four years, the produce and descendants of a single pair may amount to nearly 15,000. A composition of loam, old rubbish and salt, will not only entice birds of this species to remain in a required spot, but will even decoy those belonging to other places, and is therefore prohibited by law. The carrier pigeon is easily distinguished from the other varieties, by a broad circle of naked white skin round the eyes, and by its dark blue or blackish colour. The bird is conveyed from its home to the place whence the information is intended to be sent; the letter is tied under its wing, and it is let loose. From the instant of its liberation, its flight is directed through the clouds, at an amazing height, to its home, and it darts onward in a straight line to the very spot from which it was taken, by virtue of some faculty or instinct which it is very difficult to explain. To measure their speed with some degree of exactness, a gentleman some years ago, on a trifling wager, sent a carrier pigeon from London, by the coach, to a friend at St Edmund's-bury, and along with it a note, requesting that the pigeon, two days after its arrival there, might be thrown up precisely when the town-clock struck nine in the morning. This was accordingly done, and the pigeon arrived in London, and flew into the Bull Inn in Bishop's-Gate Street, at half an hour past eleven o'clock of the same morning, having flown 72 miles in two hours and a half.

707 *Coronata.* *Great crowned Indian pigeon*.—Bluish; cinereous above; orbits black; crest; shoulders ferruginous. Size of a turkey. Inhabits New Guinea.

708 *Cristata.* *Lesser crowned pigeon*.—Eyelids white; hind head with a red gold crest; breast and belly violet; back, rump, and tail green; legs yellow; hind toe unarmed. Size of the common pigeon. Inhabits Malacca.

709 *Palumbus.* *Ring dove*.—Cinereous; tail feathers black on the hind part; primary quill feathers whitish on the outer edge; neck white on each side; bill yellowish; cere red and scurfy; irides yellowish; head, back, and wing-coverts bluish; rump and throat pale ash; breast claret colour; belly and vent whitish; neck above and at the sides green gold, with a white crescent on each side; feet rough as far as the toes. Weighs about 20 ounces; length eight inches. Inhabits Europe, and rarely Siberia. From its living in woods, and building in trees, it is not uncommonly called *wood pigeon*. It seems to be originally a native of this island, and probably migrates no farther than from the northern to the southern parts of it. Early in spring it begins to pair, at which time the male is observed to fly in a singular manner, alternately rising and falling in the air. It forms a nest of a few small sticks loosely put together. Its common food is grain and seeds of all kinds, acorns and beech-nuts, and in default of these, turnip-greens, and young clover, or even green corn, and ivy berries. Various attempts to domesticate this species have proved unsuccessful.

Green turtle.—Brass green above, purple-violet beneath. Near eight inches long. Inhabits Amboina. 710 *Viridis.*

Turtle dove.—Tail feathers tipt with white; back gray; breast flesh-coloured; a spot of black feathers, tipt with white, on each side of the neck; bill brown; irides yellow; crown olive-ash; front and chin nearly white; scapulars and coverts reddish-brown, spotted with black; throat and breast claret-coloured; belly and vent white; two middle tail feathers dusky-brown, the end and exterior side of the outermost feathers white. Subject to several varieties. About 12 inches long. Inhabits Europe, China, and India. Visits the southern parts of England in the spring, and leaves them in the beginning of September. Is very shy and retired, breeding in thick woods, and nestling on high trees. Is very destructive to fields of pease. 711 *Turtur.*

B. *Tail long and wedged.*

Passenger pigeon.—Orbits naked and sanguine; breast rufous. From 15 to 16 inches long. Inhabits North America, migrating southward in December in quest of food. The multitudes which pass in hard winters are truly astonishing, as they fly by millions in a flock, and literally intercept the light of the sun. As soon as one flock has passed, another succeeds; and these movements sometimes continue for three days without intermission. Their favourite food is acorns; but they not only eat the fruit of various kinds of trees, but also corn and rice, of which they are very unsparing in the course of their passage. 712 *Migratoria.*

Black-winged pigeon.—Body livid; wings black. Inhabits Chili. 713 *Melanoptera.*

Marginated turtle.—Breast red; tail feathers tipt with black, and edged with white; bill horny; irides rufous; front and chin reddish brown; lores white; hind head bluish-ash colour; a black spot under the ears; body above brown; shoulders spotted with black; rump cinereous; throat and breast rosy; two middle tail feathers blackish; the rest ash colour. Ten inches long. Native of America. 714 *Marginata* Plate CCCCI. fig. 1.

Bantam pigeon.—Orbits naked and flesh-coloured; neck, breast, and flanks, waved with black and white. Size of the wry-neck. Inhabits Java. 715 *Bantamensis.*

Gen. 76. ALAUDA, *Lark*. 716 ALAUDA.

717 Characters. Bill cylindrical, subulated, straight; the mandibles equal, and a little gaping at the base; tongue bifid; hind claw straight, and longer than the toe.

 Field

Passeres.

718 Arvensis. *Field* or *sky lark*.—Outer webs of the two middle tail feathers white, middle ones ferruginous on the inner side; body above varied with blackish, reddish-gray, and whitish; reddish-white beneath; bill and legs black; throat spotted with black. A variety sometimes occurs that is wholly white, another which is black-brown, and a third, which is found in Russia, and distinguished by its very long legs. This well-known species is about seven inches long, and inhabits Europe, Asia, and Africa. It is most common in the open and upland cultivated districts in which corn abounds, and is rarely seen on extended moors at a distance from arable land. The nest is placed on the ground, among grass or corn, and is formed of dry grass and other vegetable stalks, and lined with fine dry grass. The eggs are generally four, rather larger than those of a tit-lark, and of a dirty white, blotched and spotted with brown. The sky lark begins to breed in May, and will lay as late as September, if its first nests are destroyed. The incubation lasts a fortnight, and two broods are usually produced in the course of the year. When hatched, the mother watches over them with the most tender solicitude and affection. They are first fed with worms and insects; but after they are grown up, they live chiefly on seeds, herbage, and most other vegetable substances. They are easily tamed, and become so familiar as to eat off the table, and even alight on the hand. The lark becomes tuneful early in spring, and continues so during the summer. His song is chiefly heard in the morning and evening; and he is one of those few birds that chaunt their mellow notes on the wing. We need scarcely remark, that he mounts almost perpendicularly, and by successive springs into the air, where he hovers at a great height, and whence he descends in an oblique direction, unless threatened by some ravenous bird of prey, or attracted by his mate, when he drops down to the ground like a stone. When he first leaves the earth, his notes are feeble and interrupted, but, as he rises, they gradually swell to their full tone. These birds cease their strains in winter, when they assemble in flocks, grow fat, and are taken in multitudes by the bird-catchers. Four thousand dozen have been taken in the neighbourhood of Dunstable, between September and February; and Kepler informs us, that the excise on larks alone produces about 900l. a-year to the city of Leipsic, whose neighbourhood is celebrated for larks of a peculiarly delicate flavour.

719 Pratensis. *Tit lark*.—Greenish-brown, outer webs of the two outermost tail feathers white; eyebrows with a white line; bill black; body white beneath; breast ochreous yellow, with oblong black spots; legs yellowish. Length nearly five inches and three quarters. Inhabits Europe, and is very common in most parts of this island, though it seems partial to barren situations, and occurs both in mountainous and low swampy places. In Scotland, it is almost the only bird which frequents the extensive heath tracts on which it breeds. It has a fine note, and sings either sitting in trees, or on the ground.

720 Minor. *Lesser field lark*.—Reddish-brown, spotted beneath; chin and belly white; throat and breast obscure yellow; legs brownish; wing coverts edged with white; quill feathers dusky, the outer web of the first edged with white, the others with yellowish-green; hind claw short, and sometimes hooked. Somewhat larger than the preceding, with which it has been often confounded. It visits this country in spring, but is rarely seen till the beginning of May; is not plentiful, and chiefly affects enclosed situations. From the beginning of May till July, it may be seen mounting in the air in a fluttering manner, at the same time uttering a twittering note, and then descending to some neighbouring tree with motionless wing and the tail thrown up. It then sings sweetly, but never when rising. In generally nestles in the high grass or green wheat, and lays four eggs of a dirty bluish white, thickly blotched and spotted with purplish brown.

721 Arborea. *Wood lark*.—Head surrounded by a white annular fillet; body varied like the *arvensis*; legs flesh coloured. Weighs about eight drams; length six inches. Inhabits Europe and Siberia, and is met with, though sparingly, in various parts of Britain. It sings delightfully on wing, but rarely when sitting on the ground, though sometimes when perched on a tree. Its song is much more melodious than that of the sky lark, but does not consist of so great a variety of notes; but then it frequently sings in the night, and through most of the year, except in the months of June and July. It does not ascend in the air perpendicularly, and continue hovering and singing in the same spot, like the sky lark, but will sometimes soar to a great height, and keep flying in large irregular circles, singing with little intermission; and will thus continue in the air for an hour together. It is an early breeder, the eggs being sometimes found in the nest in the beginning of April.

722 Rubra. *Red lark*.—Brown; orbits blackish; two outermost tail feathers white. About the size of the sky lark. Inhabits North America, and is sometimes found near London.

723 Malabarica. Plate CCCCI. fig. 3. *Malabar lark*.—Wings and tail dirty brown colour, with reddish edges; bill black; crest long, brown and tipt with white; chin and belly reddish white; feathers of the back, and coverts of the wings, brown; the edge reddish towards the tip, and marked with a white spot; legs reddish. Five inches and a half long. Native of Malabar.

724 Trivialis. *Grasshopper lark*, or *grasshopper warbler*.—Tail feathers brown, the outer one half white, the second with a white wedged tip; wings with two whitish lines; bill dusky; legs whitish; lores white; body greenish-brown above, feathers dusky in the middle, yellowish-white beneath; breast dirty white; tail longish, and somewhat wedged. Length five inches and a half; weight about three drams and a quarter. Inhabits Europe. Though not plentiful in Britain, it perhaps appears to be much less so from its extreme shyness, and its habit of concealing itself among furze and thick hedges. Its singular note resembles the chirping of the larger species of crickets.

725 Obscura. *Rock lark*.—Olive brown, varied with blackish; yellowish beneath; sides of the neck and breast with brownish spots; outermost tail feathers obliquely half whitish, second whitish at the tip. Upwards of seven inches long. In its song, manner of flying, and general habits, is much allied to the tit lark. Inhabits some of the rocky shores of England, and seems to subsist chiefly on marine insects.

726 Nemorosa. *Lesser crested lark*.—Tail feathers black, the two outermost white on the outer edge; head crested; legs red; body pale brown. Inhabits Europe and Siberia, and is

Passeres. is common in Yorkshire. It is a solitary bird, and builds in woods and thickets.

727 Calandra. *Calandre lark.*—Outermost tail feathers totally white without, second and third tipt with white; pectoral band brown. Seven inches and a quarter long. Inhabits Italy and Russia. Builds on the ground. Sings sweetly, and imitates the notes of other birds.

728 Sturnus.

Gen. 77. Sturnus, *Stare*, or *Starling*.

729 Character. Bill subulate, angular, depressed, somewhat blunt; the upper mandible entire, and somewhat open at the edges; nostrils surrounded with a prominent rim; tongue notched and pointed.

730 Vulgaris. *Common stare* or *starling.*—Bill yellowish; body black, with white dots; quill feathers and tail dusky; the former edged with yellow on the outer side, the latter with dirty green; lesser coverts edged with yellow, and slightly glossed with green; legs reddish-brown. Male shining with purple, green, and gold. There are several varieties. Weight about three ounces; length eight inches and three quarters. Found in almost every part of the old continent. It breeds in the hollows of trees or rocks, among rubbish, or in old towers, and sometimes appropriates the nest of another bird. Myriads of this species breed among the rocks in the Orkney islands, and in the winter feed on the *cancer pulex*. Their general food is insects, earth-worms, seeds, berries, &c. They migrate in flocks, and are very noisy. In confinement it may be taught to mimic various sounds, and even to speak. So attached are they to society, that they not only join those of their own species, but also birds of a different kind; and are frequently seen in company with redwings, fieldfares, and even with pigeons, jackdaws, and owls. They chatter much in the evening and morning, both when they assemble and disperse.

731 Cinclus. *Water-ouzel*, or *crake.*—Black; breast white; chin white; tail black; belly ferruginous; legs pale blue before, black behind. Length seven inches and a half. Inhabits Europe and northern Persia. Is shy and solitary, and rarely to be seen, except on the banks of rivers, and streams of water. It is not unfrequent in the mountainous parts of Scotland and Wales, and in some districts in Devonshire. In these places it breeds, and continues the whole year. The nest is very large, formed externally of moss and water plants, and lined with dry oak leaves, resembling that of the wren, with a dome or covering. It is usually placed in some mossy bank, impending on the water, and contains five or six eggs of a transparent white. "A pair of these birds, says Mr Montagu, which had for many years built under a small wooden bridge in Caermarthenshire, we found had made a nest early in May. It was taken, but had no eggs, although the bird flew out of it at the time. In a fortnight after they had completed another nest in the same place, containing five eggs, which was taken; and in a month after we took a third nest under the same bridge with four eggs; undoubtedly the work of the same birds, as no others were seen about that part. At the time the last was taken, the female was sitting, and the instant she quitted her nest, plunged into the water, and disappeared for a considerable time; at last she emerged at a great distance down the stream. At another time we found a nest of this bird in a steep projecting bank over a rivulet clothed with moss. The nest was so well adapted to the surrounding materials, that nothing but the old bird flying in with a fish in its bill would have led to a discovery. The young were nearly full feathered, but incapable of flight, and the moment the nest was disturbed, they fluttered out and dropt into the water, and to our astonishment, instantly vanished; but in a little time made their appearance at some distance down the stream; and it was with difficulty two out of five were taken, as they dived on being approached.—The aquatic habits of this bird have not escaped the notice of ornithologists, some of whom speak of their flying under water. If, indeed, the wings being in motion can be called flying, in certainly does; but this is no more than is common to all diving birds, which, in pursuit of fish, or to escape danger, always use their wings to accelerate their motion. In this case, however, the wings are not extended, for that would retard their progress; but it is effected by short jerks from the shoulder joint. Whether these birds can run at the bottom of the water, as some have asserted, is much to be doubted, as it is requisite all birds should use a considerable exertion to keep them under water, by reason of their specific gravity being so much less. It is certainly a most curious and singular circumstance, that a bird, not apparently in the least formed for diving, should pursue its prey under water, living chiefly on small fish and aquatic insects. It cannot, however, swim on the surface."

Green stare.—Green above; bluish beneath; a tuft of black and white feathers on the front and chin. Inhabits China. 732 Viridis.

Wattled Stare.—Bill and legs black; a pendent orange wattle at each angle of the mouth. Male black, with the back and wing-coverts ferruginous. Female rusty-brown, with very small wattles. Ten inches long. Inhabits New Zealand. 733 Carunculatus.

Collared stare.—Blackish brown, spotted with brown; flanks rufous; chin white, spotted with brown. Size of the fieldfare. Inhabits Switzerland and Italy. Is solitary, wags its tail, feeds on seeds, sings with a very weak voice, and builds in the ground, or in clefts of rocks. 734 Collaris.

Gen. 78. Turdus, *Thrush*. 735 Turdus.

Bill somewhat straight; upper mandible a little bending and notched near the point; nostrils naked or half covered with a small membrane; mouth ciliated, with a few bristles at the corners; tongue jagged. 736 Characters.

Most of the numerous species of this genus feed on berries, especially those of the juniper; and many of them are excellent songsters.

Missel thrush.—Back brown; neck spotted with white; bill yellowish; body whitish-yellow beneath, with spots brown on the chin and white beneath; quill and tail feathers brown, with paler edges; the three outermost tipt with white; legs yellow; claws black. Weight near five ounces; length 11 inches. Inhabits the woods of Europe. It is by no means plentiful in Britain, and appears to be less so in winter. It begins to sing in January if the weather is mild, but ceases as soon as the thermometer sinks below 40 degrees. A- 737 Viscivorus.

bout

Passeres. bout the middle of March it makes a nest in the fork of some tree, especially if covered with lichen, and seems partial to the apple tree, frequenting orchards more than other situations in spring, and never building in a bush. The nest is made of mosses, lichens, and dry leaves, lined with withered grass, and fortified on the outside with small sticks. The eggs are four or five, rarely six; of a flesh colour, and marked with deep and light rust-coloured spots. The song of this bird is louder than that of the throstle, and superior to it. Perching on the uppermost branch of a tall tree, the missel thrush sings when its mate is making the nest, and during incubation; but becomes silent as soon as the young are hatched, and is no more heard till the beginning of the new year. If the young are taken, its song continues as before, and if the female is destroyed, it continues in song the whole summer. The missel is very bold during the breeding season, driving other birds from the neighbourhood of its nest, and even attacking the magpie and jay. Its food is insects and berries, particularly those of the misletoe, which are frequently propagated after passing through the digestive organs of this bird.

738 *Pilaris.* *Fieldfare.*—Tail feathers black, the outermost at the inner edge tipt with white; head and rump hoary; bill yellowish, tipt with black; crown and neck olive ash above; body bay above; quill feathers cinereous; throat and breast yellowish-rufous; belly and vent whitish; legs blackish. Subject to three or four varieties. Length 10 inches; weight four ounces. Inhabits Europe, Syria, and Siberia. Arrives in Britain, in large flocks, about Michaelmas, and leaves us in March. It feeds on the berries of the holly, thorn, juniper, *empetrum nigrum*, *arbutus alpina*, &c. as well as on worms and insects. In very severe weather they migrate farther south, if not prevented by a sudden fall of snow. In 1798, when a very heavy snow fell on the northern and eastern parts of England, prodigious flocks of fieldfares appeared in the west; but as that part of the island also was soon covered with snow, which lay on the ground for a considerable time, they became too weak to advance farther south, and thousands were picked up, starved to death. Though it builds in trees, and sits on them in the day time, it always roosts on the ground. When a person approaches a tree that is covered with them, they continue fearless, till one at the extremity of the bush, rising on its wings, utters a loud and peculiar note of alarm, when they all immediately fly, except one other, which remains till the person approaches still nearer, and then it also flies off, repeating the note of alarm. Fieldfares were highly esteemed by the Roman epicures, who kept them in their aviaries, and fattened them with crumbs of bread, mixed with minced figs. According to Varro and Plutarch, the flesh was sometimes bitter.

739 *Iliacus.* *Redwing* or *wind thrush.*—Wings ferruginous underneath; eyebrows whitish; bill blackish; legs pale gray; body gray-brown, whitish beneath, with brown spots; sides and inner coverts ferruginous; vent white. Weight nearly two ounces and a half; length eight inches and a half. Inhabits Europe, and is a winter guest with us, appearing a few days before the preceding, migrating in vast flocks. It breeds in Sweden, Norway, &c. where it inhabits the maple woods, and sings delightfully from their highest tops. It builds in hedges or thickets, and lays six bluish-green eggs, spotted with black. In the southern countries of Europe, it does great injury to the vineyards.

740 *Musicus.* *Throstle* or *song-thrush*; *mavis* of the Scotch.—Quill feathers ferruginous at the inner base. Resembles the missel in colour, but the inner wing coverts are yellow, irides hazel, bill brown, and the mouth yellow within. Inhabits the woods in Europe. Weight about three ounces; length nine inches. This well-known species is generally admired for its song. Every wood and grove re-echoes with its notes, which sometimes vie with those of the missel. The throstle frequently sings as early as February, if the weather is mild, and in March the female makes its nest, composed of dried grass and green moss externally, and plastered within with rotten wood, mixed with cow dung or clay, and so compactly as to hold water, a circumstance which, in a rainy season, sometimes proves fatal to the eggs. The latter are four or five, of a blue colour, and spotted with black at the larger end. The nest is sometimes placed on the stump of a tree, very near the ground, or against the side of a tree, and frequently in a hedge, or solitary bush. Though the throstle feeds on berries and insects in general, it is particularly fond of shelled snails, especially of the *helix nemoralis*, whose shell it breaks by repeated strokes against a stone. It is not uncommon to find a great many fragments of shells together, as if a number had been conveyed to one particular stone for the purpose. This species breeds twice, and sometimes thrice in the year, and consequently continues long in song. Like the preceding, it is very hurtful to vineyards.

741 *Polyglottus.* *Mocking bird*, or *mimic thrush.*—Dusky-ash above; pale ash beneath; primary quill feathers white on the outer half; bill black; irides yellow; tail four inches long; legs cinereous. Nine inches and a half long. Inhabits the moist woods of Virginia, Carolina, Jamaica, &c. In the summer is seen much more to the northward than in winter. This singular species not only possesses musical and solemn notes of its own, but can at pleasure assume the tone of every other animal in the forest, from the humming bird to the eagle, and descending even to the wolf or the raven. One of them, confined in a cage, has been heard to mimic the mewing of a cat, the chattering of a magpie, and the creaking of the hinges of a sign-post in high winds. It is said to take a pleasure in archly deceiving other birds, alluring the smaller kinds, for example, with the call of their mates, and then terrifying them with the scream of an eagle. In the warmer parts of America, it sings incessantly from March to August, both day and night, beginning with its own compositions, and frequently finishing by borrowing from the whole feathered quire, repeating its tunes with such artful sweetness as to excite both pleasure and surprise. The female frequently builds her nest in the bushes or fruit-trees about houses, but is so very shy, that if a person only looks at the nest, she immediately forsakes it. It feeds on grasshoppers, different kinds of berries, &c. and is itself eaten by the Americans, who account it very delicate food.

742 *Orpheus.* *Mocking thrush.*—Back brown; breast and lateral tail feathers whitish; eyebrows white. Eight inches and a half long; inhabits South America, and resembles the last in its fine song and imitative notes.

743 *Pagodarum.* *Pagoda thrush.*—Black; back and rump gray; vent white;

Passeres. white; head crested. Size of a finch. Inhabits Malabar and Coromandel, chiefly about the temples and pagodas.

744 *Curæus.* *Chili thrush.*—Glossy black; bill somewhat striated; tail wedged; bill, eyes, legs, and flesh black; tail five inches long. About the size of the missel; is common in Chili, where it sings sweetly; imitates the notes of other birds, and, when tamed, the voice of man. Feeds on worms, seeds, and even on smaller birds, which it kills by perforating the skull with its bill. Congregates with starlings, and makes a nest of twigs and fibres, mixed with mud, and lined with hair. Lays three bluish-white eggs.

745 *Roseus.* *Rose-coloured thrush.*—Pale rosy; head, wings, and tail black; hind head crested. About eight inches long. Inhabits Europe and Asia, and has been found, though very rarely, in England. As it feeds chiefly on locusts, it is held sacred by the Turks.

746 *Cantans.* *Musician thrush.*—Reddish-brown, varied with transverse dark streaks; whitish beneath; chin, cheeks, and throat reddish-orange; a black blotch spotted with white on each side of the neck. Four inches long. Inhabits the woods of Cayenne. Is solitary; feeds on ants and other insects, and is celebrated for its sweet and variable note.

747 *Tintinnabulatus.* *Chiming thrush.*—Brown above; under parts and rump reddish-tawney; chin white; cap and cheeks white, spotted with black; eyebrows and streaks behind the eyes black. Four inches long. Inhabits the woods of Cayenne and Guiana. Its note resembles the chiming of bells.

748 *Tinniens.* *Alarum thrush.*—Brown above; white beneath; breast spotted with black; tail even; bill black above, white beneath; legs pale plumbeous. Six inches and a half long. Inhabits Cayenne. Every morning and evening, for the space of an hour, cries with a harsh loud voice, like an alarum bell.

749 *Rex.* *King thrush.*—Reddish-brown above, paler beneath; hind head lead-coloured; front varied with white and brown. Seven inches and a half long. Inhabits South America, near the hillocks raised by the white ants, on which it feeds.

750 *Merula.* *Blackbird.*—Black; bill and eyelids yellow. Female, and the young male rusty black, and bill dark. There is a variety with the head white, another with the body white and black, and a third entirely white. Inhabits Europe and Asia. A well-known species, admired for its song, which is a shrill kind of whistle of various notes, enlivening the early days of spring. The nest is externally composed of green moss, fibrous roots, &c. having the inside plastered with earth, and then lined with fine dry grass. The female lays four or five blue eggs, thickly covered with pale ferruginous brown spots. The blackbird feeds principally on worms and shelled snails, but is also fond of insects and fruit in general. It breaks the shell of the snail with great dexterity on a stone. In confinement it readily eats crumbs of bread, and flesh either raw or prepared for the table. With us it is never observed to migrate or to congregate, but lives solitary in woods and inclosed situations. It is easily tamed, and imitates other sounds, even that of the human voice.

751 *Torquatus.* *Ring ouzel.*—Blackish; bill yellowish; collar white. Rather larger than the blackbird. Inhabits Europe, Asia, and Africa. Is migratory in some countries, but is known to remain and breed in the mountains of Scotland and Wales. When fattened, its flesh is much esteemed. In its habits it is nearly allied to the blackbird. Passeres.

Reed thrush.—Rusty brown; white testaceous beneath; quill feathers brown, tipt with reddish. Frequently varies in its markings. Inhabits the reedy marshes of Europe, builds a hanging nest among the reeds, and lays from five to six yellowish white eggs spotted with brown. The male sings while the female is sitting. 752 *Arundinaceus.*

Songster thrush.—Greenish-black, shining with blue or violet; wings and tail black. Inhabits the Philippine isles in numerous flocks; sings very sweetly, and often lays in pigeon houses. 753 *Cantor.*

Gen. 79. Ampelis, *Chatterer*. 754 Ampelis.

Bill straight, convex, somewhat incurved; each mandible notched; nostrils covered with bristles; tongue sharp, cartilaginous, and bifid; middle toe connected at the base to the outermost. 755 Characters.

Waxen or *Bohemian chatterer*.—Hind head crested; secondary quill feathers tipt with red horny appendages; bill and legs black; irides bright ruby; cheeks tawney; throat black, with a small bristly tuft in the middle; head and body reddish-ash above; ocular line and chin black; breast and belly pale purplish bay; lesser wing-coverts brown; greater remotest from the body black, tipt with white; quill feathers black, three first tipt with white; six next with half an inch of the exterior edge yellow; inner white; tail black, tipt with yellow. Length about eight inches; size nearly that of a starling. Inhabits Europe, Northern Asia, and America. Occasionally visits this country, migrating in flocks. In the month of February, it frequents the neighbourhood of Edinburgh, where it feeds on the berries of the mountain ash. It is supposed to breed farther north, and to build in the holes of rocks. Its flesh is excellent. 756 *Garrulus.*

The other species of this genus are all inhabitants of the warmer parts of America.

Gen. 80. Colius, *Coly*. 757 Colius.

Bill short, thick, convex above, and flat beneath; upper mandible bent down at the tip; nostrils small at the base of the bill, and nearly covered with feathers; tongue jagged at the tip; tail long and wedged. 758 Characters.

Cape coly.—Outermost tail feathers white on the outside; body cinereous; whitish beneath. Ten inches and a quarter long. Inhabits the Cape of Good Hope. 759 *Capensis.*

Panayan coly.—Above yellowish ash colour; beneath rufous; breast streaked with black; head crested; bill black; legs pale flesh colour; tail very long, the feathers of which are of different lengths. Native of Panay, one of the Philippine islands. 760 *Panayensis.* Plate CCCCII. fig. 2.

Green coly.—Shining green; hind head and eyelids silky black; wings and tail blackish. Twelve inches long. Inhabits New Holland. 761 *Viridis.*

Indian coly.—Cinereous above; rufous beneath; hind head and chin yellow; lores and naked orbits yellow. Fourteen inches long. Inhabits India. 762 *Indicus.*

Gen.

Gen. 81. Loxia, *Grossbeak*.

763 Loxia. 764 Characters. Bill strong, thick, convex, and rounded at the base; lower mandible bent in at the edge; nostrils small, round at the base of the bill; tongue truncated.

765 *Curvirostra.* *Crossbill*, or *sheld apple*.—Mandibles crossing each other; body varying in colour; wings and forked tail brown; varies, with a reddish head and scarlet body. Male red, varied with brown and green. Female olive green, mixed with brown. Weighs about an ounce and a half; length near six inches and a half. Inhabits Europe, Asia, and America. Is not known to breed with us, but is more or less found among fir plantations from June to the latter end of the year, feeding on the seed by dexterously dividing the scales of the cones, for which purpose the bill is admirably adapted. It is sometimes found in orchards in autumn, and will readily divide an apple to get at the kernels. Many are taken with a bird-call and birdlime; and others by a horse-hair noose fixed on a long fishing rod; for so intent are these birds on picking out the seeds of the cone, that they will suffer themselves to be taken by the noose being put over their head. The crossbill breeds in the northern countries early in the month of March, on the tops of the pine trees, making its hemispherical nest of twigs, and of the *sphagnum arboreum*, two inches and a half thick, lining it with the *lichen floridus*, and stopping up the chinks with rosin. It is capable of being tamed, and in confinement climbs up the wires of a cage by the claws and beak.

766 *Coccothraustes.* *Grossbeak*, or *hawfinch*.—Chesnut ash; wings with a white line: middle quill feathers rhombic at the tips; tail feathers black at the base of the thinner web; orbits and chin black; tail spotted with white within. The length of this species is six inches; weight about two ounces. The plumage is subject to great variety. It inhabits Europe, and usually appears in Britain in the autumn, continuing till April, and appearing in small flocks of four or five, but not commonly. It is more plentiful in France, and breeds in Burgundy in April. The nest is composed of dried fibres intermixed with liverwort, and lined with finer materials. The eggs are of a bluish green spotted with olive brown, with a few irregular black markings. This bird lives on the kernel of the almond, walnut, and cherry, breaking with the greatest ease their hard stones with its bill.

767 *Enucleator.* *Pine grossbeak*.—Wings with a double white line; tail feathers all black; head, neck, breast, and rump in the young bird, red; in the old yellow; female olive. Nine inches long. Inhabits Europe, Asia, and America, but is limited to the northern regions of these quarters of the globe, and especially to the pine forests. In this island it is only found in the north of Scotland, where it is also supposed to breed. It sings excellently, and during the night, but soon ceases. It builds in trees pretty near the ground a nest of small sticks, and lines it with feathers, laying four eggs. Its food is the seed of the pine.

768 *Pyrrhula.* *Bullfinch*.—Cinereous; head, wings, and tail black; coverts of the tail, and hindermost quill feathers white; crown black; breast cinereous; belly of the male red, of the female chesnut. Scarcely six inches long, and liable to vary in its markings. Inhabits Europe and Siberia. In summer it frequents woods, and in winter haunts orchards and gardens, where it preys on the young buds of the trees. It is not gregarious, but is usually observed in pairs, or on broods, and remains with us all the year, making a nest of small dry twigs, lined with fibrous roots, in some thick bush, either in woods or hedges, about the latter end of April or beginning of May, and laying four or five eggs of a bluish-white, speckled and streaked with purple, and rather larger than those of a linnet. The native notes of the bullfinch are few, but remarkably soft, and uttered in so low a tone as to escape a common observer; the call notes are simple, but more audible. In confinement it becomes very docile, and may be taught a great variety of tunes, and even to imitate human speech. But it also acquires harsh strains with equal facility. A friend of the Comte de Buffon saw one of this species that had never heard any person whistle but carters; and it whistled with their strength and coarseness. These birds are also susceptible of strong and durable attachments. Some have been known, after escaping and living a whole year in the woods, to recognise the voice of their mistress, and return to forsake her no more, and others have died of melancholy on being removed from the first object of their attachment.

Cardinal grossbeak.—Crested; red; frontlet black; bill and legs blood red; crest, when erect, pointed. Nearly eight inches long. Inhabits North America. From the melody of its song, some of the Americans call it *nightingale*. In spring, and during great part of summer, it sits on the tops of the highest trees, and makes the forests echo with its song. During summer, it lays up its winter provision of maize and buck-wheat. Nearly a bushel of the former grain has been found in the retreat of one of these birds, artfully covered with leaves and small branches of trees, and only a small hole left at which the bird enters. In cages it will sing with a very short interval of silence, through the whole year. 769 *Cardinalis.*

Molucca grossbeak.—Colour brownish; the head, throat, and tail feathers are black; beneath waved with white and black; bill black; hindhead, wings and legs brown; rump waved with white and black. Four inches long. Inhabits the Molucca islands. 770 *Moluccensis.* Plate CCCCL. fig. 2.

Hamburgh grossbeak.—Head and neck chesnut above; chin, band in the middle of the white throat and rounded tail brown; back, breast, and rump yellowish-brown, spotted with black; belly, vent, and two bands on the wing-coverts white. Nearly six inches long. Inhabits the neighbourhood of Hamburgh. Feeds on insects, and climbs trees like the creeper. 771 *Hamburgia.*

Greenfinch, or *green grossbeak*; provincially *green linnet*.—Yellowish-green; primary quill feathers edged with yellow; four lateral tail feathers pale yellow at the base; bill brownish; legs flesh coloured; female browner. Rather larger than the house sparrow; weight nearly eight drams; length six inches and a half. Inhabits Europe and Kamtschatka; is very common in most parts of this country in summer; becomes gregarious in winter, and associates with chaffinches and yellow hammers; but in severe weather migrates from particular districts. It is rather a late breeder. The nest is composed of small dry twigs, bents, and moss, interwoven with wool, and lined with hair and feathers. It is commonly placed among ivy surrounding a tree, or in some 772 *Chloris.*

Passeres. some thick bush. The eggs are four or five; white, speckled with rusty red at the larger end, and much like those of the linnet, but larger. The principal food of this bird is seed and grain. It is easily tamed if held on one's fingers in the dark and heated gently. Though its native song is trifling, in confinement it will catch the notes of other birds.

773 *Sulphurata.* *Brimstone grosbeak.*—Olive brown; throat and belly pale yellow; eyebrows yellow. Nearly six inches long. Inhabits in flocks near the Cape of Good Hope, frequents the banks of rivers, and builds a pendulous nest, with a long neck beneath, in trees and shrubs.

774 *Bengalensis.* *Bengal grosbeak.*—Gray; crown yellow; temples whitish; belly whitish, spotted with brown. "This bird (says Sir William Jones) is exceedingly common in Hindostan: he is astonishingly sensible, faithful and docile; never voluntarily deserting the place where his young are hatched, but not averse, like most other birds, to the society of mankind, and easily taught to perch on the hand of his master. In a state of nature he generally builds his nest on the highest tree that he can find, especially on the palmyra, or on the Indian fig tree, and he prefers that which happens to overhang a well or a rivulet; he makes it of grass, which he weaves like cloth, and shapes like a large bottle, suspending it firmly on the branches; but so as to rock with the wind, and placing it with its entrance downward to secure it from birds of prey. Its nest usually consists of two or three chambers; and it is popularly believed that he lights them with fire flies, which he is said to catch alive at night, and confine with moist clay or with cow dung. That such flies are often found in his nest, where pieces of cow dung are also stuck, is indubitable; but as their light could be of little use to him, it seems probable that he only feeds on them. He may be taught with ease to fetch a piece of paper, or any small thing that his master points out to him. It is an attested fact, that if a ring be dropt into a deep well, and a signal given to him, he will fly down with amazing celerity, catch the ring before it touches the water, and bring it up to his master with apparent exultation; and it is confidently asserted, that if a house or any other place be shown to him once or twice, he will carry a note thither immediately on a proper signal being made. One instance of his docility I can myself mention with confidence, having often been an eye witness of it. The young Hindoo women at Benares, and in other places, wear very thin plates of gold called *ticas*, slightly fixed, by way of ornament, between their eyebrows; and when they pass through the streets, it is not uncommon for the youthful libertines who amuse themselves with training these birds, to give them a signal which they understand, and send them to pluck the pieces of gold from the foreheads of their mistresses, which they bring in triumph to their lovers."

775 *Canora.* *Brown-cheeked grosbeak.*—Dirty greenish; cinereous beneath: cheeks brown, surrounded with a yellow fringe. Inhabits Mexico, and sings delightfully.

776 *Philippina.* *Philippine grosbeak.*—Brown; yellowish white beneath; crown and breast pale yellow; chin brown. Inhabits the Philippine islands. A variety found in Abyssinia, has the tail and quill feathers greenish brown, and edged with yellow. Constructs a nest like the *bengalensis*.

777 *Abyssinica.* *Abyssinian grosbeak.*—Yellowish; crown, temples, throat, and breast, black; shoulders blackish; quill and tail feathers brown, and edged with yellow; irides red; wing-coverts brown, edged with gray; legs reddish-gray. Size of the hawfinch. Inhabits Abyssinia. This bird forms a curious nest of a pyramidal shape, which is suspended from the ends of branches like the nests of some others of this tribe. The opening is on one side, facing the east; the cavity is separated in the middle by a partition of half its height; up this the bird ascends perpendicularly, and then descending on the other side, forms its nest in the further chamber. By this means the brood is defended from snakes, squirrels, monkeys, and other mischievous animals, besides being secured from the rains, which in that country last sometimes for five or six months together.

778 *Pensilis.* *Pensile grosbeak.*—Green; head and throat yellow; ocular band green; belly gray; vent rufous red; bill, legs, tail, and quill feathers, black; the last edged with green. Size of a house sparrow. Inhabits Madagascar. Constructs a hanging nest of straw and reeds, shaped like a bag with an opening beneath, on one side of which is the true nest. The bird does not choose a new situation every year, but fastens a new nest to the end of the last, so that five may sometimes be seen hanging from one another. Builds in large societies, and produces three at each incubation.

779 *Socia.* *Sociable grosbeak.*—Rufous brown; yellowish beneath; frontlet black; tail short; bill black; region of the ears yellowish; legs brown. Inhabits the interior parts of the Cape of Good Hope, where they were first discovered by Mr Paterson. They build their nests in a species of mimosa, which grows to an uncommon size; and which, from its ample head and strong wide spreading branches, is well calculated to admit and support their dwellings. The tallness and smoothness of its trunk are also a perfect defence against the invasions of the serpent and monkey tribes. In one tree described by Mr Paterson, there could not be fewer than from eight hundred to a thousand nests under one general roof. Mr Paterson calls it a *roof*, because it resembles that of a thatched house, and projects over the entrance of the nest below in a very singular manner. "The industry of these birds (says this traveller) seems almost equal to that of the bee. Throughout the day they seem to be busily employed in carrying a fine species of grass, which is the principal material they use for the purpose of erecting this extraordinary work, as well as for additions and repairs. Though my short stay in the country was not sufficient to satisfy me by ocular proof that they added to their nest as they annually increased in numbers; still, from the many trees which I have seen borne down by the weight, and others which I have observed with their boughs completely covered over, it would appear that this is really the case. When the tree which is the support of this aerial city, is obliged to give way to the increase of weight, it is obvious that they are no longer protected, and are under the necessity of building in other trees. One of these deserted nests I had the curiosity to break down, to inform myself of the internal structure of it, and found it equally ingenious with that of the external. There are many entrances, each of which forms a regular street with nests on both sides, at about two inches distance from each other. The grass with which they build is called the *Boshman's* grass; and I believe the seed of it to be their

Passeres. their principal food; though, on examining their nests, I found the wings and legs of different insects. From every appearance, the nest which I dissected had been inhabited for many years; and some parts of it were much more complete than others. This, therefore, I conceive to amount nearly to a proof, that the animals added to it at different times, as they found necessary from the increase of the family, or rather of the nation or community."

780 Oriv. *Grenadier grosbeak.*—Gray; bill, front, and belly, black; neck and rump tawney; sometimes the wings are white, and the tail is brown. Size of a sparrow; inhabits Africa, and is found chiefly in marshy and reedy grounds. The nest is formed among the reeds with small twigs, so closely interwoven with cotton, as not to be penetrated by any weather. It is also divided into two compartments, of which the upper is for the male, and the lower for the female and the young.

Among various other species which we have not room to describe, there are two or three of a very small size, which inhabit Surinam.

781 Emberiza.

Gen. 82. Emberiza, *Bunting*.

782 Characters. Bill conical; mandibles receding from each other from the base downwards, the lower with the sides contracted, the upper with a hard knob within.

783 Nivalis. *Snow bunting, snow bird, or snow flake.*—Quill feathers white, the primaries black on the outer edge; tail feathers black, the three lateral ones white; bill and legs brown. Besides the varieties induced by age, sex, and climate, there are others which seem to be more permanent. In winter, the whole body, except the back and middle coverts, often becomes nearly white. Somewhat larger than the chaffinch. In summer, inhabits in vast flocks, the north of Europe, Asia, and America. In winter, migrates to some warmer climate. Breeds in some of the mountains of Scotland, where it is sometimes mistaken for the ortolan. It builds in the fissures of rocks, constructing a nest of grass and feathers lined with the hair and wool of the arctic fox or other quadruped, and lays five eggs. It sings well, sitting on the ground, feeds on grain, and is wakeful during the night. It is taken in great numbers in winter, when it is fat, and its flesh esteemed delicate.

784 Mustelina. *Tawney bunting.*—Quill feathers dusky, white at the base, the last wholly black; tail feathers black, the middle ones at the edge, and three lateral ones, white on each side, with a dusky spot without. Nearly seven inches long. Inhabits with the last; but is more rare. In some places it is called *sea lark* and *brambling*.

785 Montana. *Mountain bunting, lesser mountain finch or brambling.*—Five first quill feathers blackish-brown, the rest white, spotted with brown at the tips; tail feathers brown, three lateral ones all white on each side; bill yellow, tipt with black; head chesnut; chin white; upper part of the neck and back cinereous; breast and belly with longitudinal flame-coloured spots. Found in Yorkshire, Lincolnshire, and Northamptonshire, but is not common.

786 Miliaria. *Common bunting.*—Brown; spotted with black beneath; orbits rufous; bill and legs brownish; quill feathers dusky; outer edges pale yellow; tail a little forked, edged with white; legs yellowish. Weight nearly two ounces; length seven inches and a half. Inhabits Europe in large flocks during the autumn and winter. Seems partial to champaign countries, abounding with corn, and is rarely found in uncultivated parts, or in grass fields remote from arable land. While the female is employed in incubation, the male sits on the branch of a neighbouring tree, and cheers her with his rude song. The nest is placed on the ground, formed externally of straw, lined with fibrous roots or dry grass, and sometimes finished with long hairs. The eggs are from four to six, of a dirty white, spotted and veined with reddish-brown and ash-colour. These birds are sometimes brought to market, and sold for larks, to which they are little or nothing inferior, but are easily distinguished by the form of the bill, and the tooth like knob in the roof of the mouth, by the most common observer.

Ortolan.—Quill feathers brown, the first three whitish at the edges; tail feathers brown, the two lateral ones black on the outer side; bill, naked eyelids and legs yellowish; head and neck olive-ash; chin yellowish, surrounded with a cinereous line; feathers of the back and scapulars brownish-bay, black in the middle; body reddish beneath. The female is distinguished by the head and neck being cinereous, and each feather with a narrow blackish line. Somewhat less than the yellow hammer; length six inches and a quarter. Inhabits several parts of Europe, but is not found in Britain. Ortolans are common in France, Italy, some parts of Germany, Sweden, &c. migrating in spring and autumn, when they are caught in great quantities, and fattened for the table. For this purpose, they are confined in a dark room, and fed plentifully with oats and millet. They are then killed for sale, and reckoned the most delicate of food. The ortolan will sometimes sing very prettily, its note being not unlike that of the yellow hammer, but finer and sweeter. In some parts, it makes its nest on a low hedge, in others on the ground, and constructs it carelessly, like that of the lark. The female lays four or five grayish eggs, and in general has two broods in the year.—There are five or six varieties. 787 Hortulana.

Yellow hammer, or yellow bunting.—Tail feathers blackish, the two outer ones on the inner edge, with a pointed white spot; bill black; crown, cheeks and body beneath yellow; eyebrows brownish; nape greenish; feathers of the neck and back blackish down the middle, rufous at the sides, and edged with gray; rump pale tawney; wings chesnut, olive or black, mostly edged with gray; lateral ones olive without; the tip edged with white; legs yellowish-brown. The weight of this species is about seven drams: length six inches. Inhabits Europe, and is one of the most common indigenous birds of this country. Its song is as little attractive as that of the common bunting, possessing only a repetition of the same note, five or six times successively, and terminating in one more lengthened and shrill. It congregates in winter, approaching houses, and picking up scattered grains. It does not breed till late in the spring. The nest is generally placed near the ground, in some low bush or hedge, and is composed of straw and various dried stalks, lined with fine dry grass, and finished with long hair. The eggs differ somewhat in colour and size, some being nearly white, and others having a purplish hue, but all more or less marked with hair-like streaks. The number is usually three, four, or five. 788 Citrinella.

Foolish bunting, or foolish sparrow.—Reddish; head with a few blackish lines; eyebrows white. Size of the yellow. 789 Cia.

Passeres. yellow hammer. Inhabits Europe and Siberia. Is so tame as to be caught in any snare. Has a trifling note, like that of a yellow hammer.

790 Cirlus. *Cirl bunting.*—Brown; breast spotted; eyebrows pale yellow; two outmost tail-feathers with a white wedged spot; bill brown ash; head olive; temples yellow; a black spot between the bill and eyes; throat black, with a yellow band; body yellow beneath; tail slightly forked, the feathers edged with gray. Female streaked with brown beneath; chin and vent white. Length six inches and a half; weight about seven drams. Inhabits France and Italy. "We first discovered this species," says Mr Montagu, near Kingsbridge in the winter of 1800, not uncommon amongst flocks of yellow buntings and chaffinches, and procured several specimens of both sexes, killed in different places six or seven miles from that place. They are indigenous to Devonshire, but seem to be confined to the southern parts of that county contiguous to the coast, having found them extending as far as Teignmouth, at both of which places we found their nests; but have never observed them far inland. It generally builds in furze or some low bush; the nest is composed of dry stalks, roots, and a little moss, and lined with long hair and fibrous roots. The eggs are four or five in number, cinereous white, with irregular long and short curved lines, terminating frequently with a spot at one end; size rather inferior to those of the yellow bunting, to which it bears great resemblance. These birds pair in April, and begin laying early in May.—The female might readily be mistaken for that sex of the yellow bunting at a little distance, but is materially different when compared, especially in the chesnut colour of the upper parts of this bird. The note is also similar to that of the yellow bunting, but shorter, not so shrill, and the latter part not drawn out to such a length.—It is remarkable, that so common a bird as the cirl bunting seems to be in the west of England, should have so long escaped the notice of British naturalists; but in all probability this has been occasioned by their locality. It is said to be only found on the continent in the warmer parts of France and Italy; so with us it seems confined to the mildest part of England; but the winter of 1800, which was severe in Devonshire, did not force them to seek a warmer climate, but on the contrary, they continued gregarious with other small birds, searching their food among the ploughed lands."

791 Familiaris. *Familiar bunting.*—Cinereous, spotted with brown; tail feathers tipt with white; hind part of the back yellow. Size of a siskin. Was found at Java by Osbeck, and was so familiar, that if the cage door was opened, it would leap on the first person's hand that was offered; if any one whistled to it, it sang very sweetly in return, and if it saw a dish of water, it went immediately and bathed in it. It was fed with rice.

792 Oryzivora. *Rice bunting,* or *rice bird.*—Black; crown reddish; belly black; tail feathers daggered. Six inches and three quarters long. Inhabits Cuba. These birds feed on the early crops of rice in the island of Cuba; but when the rice in Carolina begins to ripen, they quit the island, and proceed to Carolina, in amazing and destructive multitudes. They arrive there in September, while the rice is yet milky; and when it grows hard they return. The birds which thus migrate are all females; but both sexes make a transient visit to Carolina in the spring.

Reed bunting, or *reed sparrow.*—Head black; body gray and black; outmost tail feathers with a white wedged spot; bill brown; throat and breast black; 793 Schœniclus. belly white, streaked with black at the sides; wing coverts and quill feathers brownish red, black down the middle; tail feathers pointed, the eight middle ones black, two middle ones rufous on each edge, the rest on the outer only; legs brownish. Weight near five drams and a half; length six inches. Inhabits the marshy and reedy districts of Europe and Southern Siberia. A brown variety occurs at the Cape of Good Hope, and a white one about Astracan. "It is somewhat extraordinary," observes the intelligent ornithologist quoted above, "that the manners and habits of so common a bird should remain so long in obscurity; even modern authors tell us it is a song bird, that it sings after sunset; and describe its nest to be suspended over the water fastened between three or four reeds. There can be no doubt, however, that the nest, as well as the song, of the sedge warbler, have been taken and confounded for those of this bird; for as they both frequent the same places in the breeding season, that elegant little warbler is pouring forth its varied notes concealed in the thickest part of a bush; while this is conspicuously perched above, whose tune is not deserving the name of song, consisting only of two notes, the first repeated three or four times, the last single and more sharp. This inharmonious tune it continues to deliver with small intervals from the same spray, for a great while together when the female is sitting. The nest is most commonly placed on the ground near water; sometimes it builds in a bush some distance from the ground; at other times in high grass, reeds, sedge, or the like, and even in furze at a considerable distance from any water; in all these situations we have met with it, but never fastened or suspended as authors have related. The nest is composed of stalks of grass, or other dry vegetable substances, sometimes partly moss, and lined with fine grass; frequently finished with long hair. The eggs, which are four or five in number, weigh about 36 grains, and are of a dirty bluish-white or purplish-brown, with numerous dark-coloured spots and veins, much resembling those of the chaffinch.

Whidaw bunting.—Black; breast red; four middle 794 Paradisea. tail feathers long and pointed, two very long; bill black. The two middle tail feathers are four inches in length, very broad, and ending in a long thread; the two next are 13 inches or more in length, very broad in the middle, narrower at the end, and rather pointed; from the middle of the shaft of this last arises another long thread; the rest of the tail feathers are only two inches and a quarter long; the two middle long ones are placed somewhat vertically, appear undulated across, and are more glossy than the others; the legs are flesh-coloured. The female is wholly of a deep brown, approaching to black, but does not acquire its full plumage till the third year. This species inhabits Africa, particularly Angola. It moults in November, and also late in spring.

Shaft-tailed bunting.—Four middle tail feathers black, 795 Regia. Plate CCCCII. fig. 1. from nine to ten inches long, equal and feathered only at the tip; bill and legs red; body above, and vent, black; body beneath, and throat, temples, and orbits, rufous; neck above spotted with black. Native of Africa. Less than the linnet.

Green-headed bunting.—Brown; head and neck olive; 796 Chlorocephala. back

Passeres. back and wing-coverts varied with brown and black; tail forked. Only two instances are recorded of this species having been found in England.

797 TANAGRA. Gen. 83. TANAGRA, *Tanager*.

798 Characters. Bill conical, pointed, notched, almost triangular at the base, and a little inclining at the tip.

799 *Jacapa.* *Red-breasted tanager.*—Black; front, throat, and breast, scarlet; bill black; lower mandible silvery, and convex on the hind part; front sometimes black; legs brown. Female purplish-brown; reddish beneath; wings and tail brown. Six inches and a half long. Inhabits South America, frequenting inhabited places, building a pendulous cylindrical nest, and feeding on fruits.

800 *Episcopus.* *Bishop tanager.*—Cinereous; wings and tail blue without. Six inches and a half long. Inhabits Cayenne, especially about the skirts of the forests, and feeds on the lesser kinds of fruits. During night it roosts on the palm leaves.

801 *Jacanari.* *Jacanari tanager.*—Black violet; wings whitish beneath; tail divaricated and forked; bill and legs cinereous. Inhabits Brazil and Guiana. Is fond of newly cultivated land; haunts small trees, particularly coffee trees. The male frequently hops upwards from a branch, alighting again, first on one foot, and then on the other, accompanying each leap by a note, and spreading out the tail at the same time. The nest is hemispherical, about two inches in diameter, and composed of dried herbs of a gray colour. The eggs are two in number, of a greenish-white, marked with small numerous red spots, deepest and most in number at the large end.

802 *Siberica.* Plate CCCCII. fig. 5. *Siberian tanager.*—Black; tips of the interscapular and rump feathers fringed with white; bill short, pale, tipt with brown; bill notched at the tip; legs black. Native of Siberia; size of a thrush.

The other species, which are numerous, and not very distinctly ascertained by authors, seem to differ from one another more in their markings than their habits.

803 FRINGILLA. Gen. 84. FRINGILLA, *Finch*.

804 Characters. Bill conical, straight, and pointed.

This is a numerous and active tribe of birds, very generally dispersed over the world, and feeding principally on insects and grain.

805 *Lapponica.* *Lapland finch.*—Head black; body gray and black; eyebrows white; outmost tail feathers with a white wedged spot. Six inches and a half long. Inhabits Europe, Asia, and America. Runs along the ground like a lark, and sings on the wing.

806 *Cœlebs.* *Chaffinch;* provincially, *beech finch, horse finch, pink,* and *twink.*—Limbs black; quill feathers white on both sides, the three first without spots; two of the tail feathers obliquely white; bill white, but in spring and summer bluish, tipt with black; crown, nape, and sides of the neck hoary; temples and throat reddish; belly and vent reddish-white; wing-coverts with a white blotch, the greater with a white band besides; quill feathers yellowish at the edge, and white at the base; tail a little forked; legs brown. The female wants the red on the breast and other parts. Rather less than the sparrow. Inhabits Europe and Africa. Continues with us the whole year; but the females migrate from Sweden to Holland in the autumn, leaving their mates behind, and return in the spring. This bird makes a most elegant nest of green moss, curiously studded with lichen, interwoven with wool, and lined with feathers and hair. It builds against the side of a tree, particularly in ivy, or in some forked branch of a bush; but particularly in apple trees overgrown with moss and lichen, and, like many other birds, adapts the materials of its nest to the surrounding colour. The eggs are four or five, larger than those of the goldfinch, of a dirty white, tinged with purple, marked with streaks and spots of dark purple. Its notes are few, and scarcely deserve the name of song. Both sexes have a monotonous call-note, which seems to express the word *twink*. This species is subject to several varieties.

Mountain finch, brambling, or *bramble.*—Base of the wings fine yellow beneath; bill yellowish, tipt with black; head, neck, and back black; in the female brown; the feathers edged with reddish-brown; rump, lower part of the breast and belly white; throat and upper part of the breast reddish-tawney; in the female reddish gray; lesser wing-coverts reddish; middle ones reddish white; greater black, tipt with white; those next the body reddish at the tip; quill feathers black, edged with yellowish; tail a little forked; legs gray. Rather larger than the preceding; length about six inches. Inhabits Europe and Asia, breeding in the northern regions. Is frequently seen in large flocks in the winter, on the coasts of Kent and Sussex, when the weather is severe, when it is sometimes so exhausted as to suffer itself to be taken up. They are also found in the interior parts of the kingdom at that season, flying in company with chaffinches and yellow hammers. In hard winters, they are also frequently seen in the neighbourhood of Edinburgh. They are partial to the pine forests in the Highlands, and live on beech mast and the seeds of other trees. They build in trees a nest formed of hypnums without, and of wood and feathers within, the female laying four or five yellowish spotted eggs. Their flesh is eatable, though sometimes bitter. 807 *Montifringilla.*

Goldfinch, or thistlefinch.—Quill feathers black; and except the outmost marked with fine yellow in the middle; two outmost tail feathers in the middle, and the rest at the tips white; bill white, tipt with black; frontlet scarlet, in the female brown; cheeks, hind head, and belly white; top of the head black; wing-coverts black, in the female brown; back, rump, and breast, chesnut-brown. This beautiful species, which is subject to great variety, is rather less than the chaffinch, and inhabits Europe, Asia, and Africa. It is gregarious in winter, lives to a great age, subsists chiefly on the seeds of the thistle, hemp, and capitated plants; is docile and easily tamed, and sings delightfully, even in confinement. It sometimes builds in hedges, but most commonly in trees, especially those that are evergreen. The nest is neatly constructed of bents, moss, and lichen, woven together with wool, and sometimes lined with wool, or hair covered with thistle down, or the pappus of the willow. The eggs are four or five, of a bluish white, with a few small spots, chiefly at the larger end. The goldfinch readily breeds with the canary and other congenerous birds. 808 *Carduelis.*

Lepid finch.—Greenish-brown; band above and beneath the eyes and chin orange; breast black. Only half the size of the canary bird. Inhabits the woods of Cuba, and sings with a weak, but very sweet note. 809 *Lepida.*

Ethiopian finch.—Deep black; irides rufous. Inhabits 810 *Ethiops.*

Passeres. habits the woods of America, feeds on fruits and seeds, is easily tamed, and sings with the feathers of the head erected.

811 Caspa. *Caspa finch.*—Reddish-gray; front and chin white; wings and tail black. Inhabits Barbary and Abyssinia, frequents granaries in large flocks, and excels the canary bird in its song.

812 Elegans. *Beautiful finch.*—Green above; neck cinereous; breast yellow; frontlet, chin, rump, and tail red; belly with curved white spots; bill and legs red; rump and tail chesnut red. Five inches long. Inhabits Africa.

813 Canaria. *Canary bird, or canary finch.*—Bill and body straw colour; quill and tail feathers greenish. Is now well known over Europe, into which it was brought from the Canary islands, about the beginning of the 16th century. It is somewhat longer than the siskin, and about five inches and a half in length. With us they are kept in a state of captivity, and partake of all the differences and varieties incident to that condition. Buffon enumerates 29 varieties, and more might probably be added to his list. "The breeding and rearing of these charming birds," says Mr Bewick, "form an amusement of the most pleasing kind, and afford a variety of scenes highly interesting and gratifying to innocent minds. In the places fitted up and accommodated to the use of the little captives, we are delighted to see the workings of nature exemplified in the choice of their mates, building their nests, hatching and rearing their young, and in the impassionate ardour exhibited by the male, whether he is engaged in assisting his faithful mate in collecting materials for her nest, in arranging them for her accommodation, in providing food for her offspring, or in chanting his lively and amorous songs during every part of the important business. The canary will breed freely with the siskin and goldfinch, particularly the former; it likewise proves prolific with the linnet, but not so readily, and admits also the chaffinch, yellow bunting, and even the sparrow, though with still more difficulty. In all these instances, excepting the first, the pairing succeeds best when the female canary is introduced to the male of the opposite species. According to Buffon, the siskin is the only bird of which the male and female propagate equally with those of the male or female canaries." Great numbers of these birds are reared in the Tyrol. Four Tyrolese usually brought over to England about 1600 of them annually; and though they carried them on their backs 1000 miles, and paid 20l. for such a number, they were enabled to sell them at five shillings a-piece. It is not generally known, that the song of the canary bird is usually composed of the notes of the tit-lark or of the nightingale. Mr Barrington saw two of the species which were imported from the Canary islands, neither of which had any song; and he was afterwards informed, that a ship brought over a great many of them with the same defect. Most of those from the Tyrol have been educated under parents whose progenitors were instructed by a nightingale. Our English canary birds, however, have more of the tit-lark's than of the nightingale's notes. The canary bird lives chiefly on the seeds of *phalaris canariensis, canabis myagrum, brassica napus, avena*, &c.

814 Spinus. *Siskin, or aberdevine.*—Quill feathers yellow in the middle; the first four without spots; tail feathers yellow at the base, and tipt with black; crown black; body yellowish; greenish above, breast greenish; wings green; throat brown, of the female white; head and back, in the female, greenish-ash, spotted with brown. Four inches and three-fourths long. Inhabits Europe, and is liable to several varieties. Though migratory in most places, it does not seem to observe any regular periods, as it is sometimes seen in large, and at other times in very small numbers. Buffon remarks, that the great flights happen only once in the course of three or four years. It conceals its nest with so much art, that it is extremely difficult to discover it. Kramer informs us, that in the forests bordering on the Danube, thousands of young siskins are frequently found, which have not dropt their first feathers, and yet it is rare to meet with a nest. It is not known to breed in this island; nor is it known whence they come over to us. In some parts it is called the *barley bird*, from its appearing when that grain is sown. Its song, though not so loud as that of the canary, is pleasing and various. It is docile and familiar in captivity, and will imitate the notes of other birds, even to the chirping of a sparrow. Like the goldfinch, it may easily be taught to draw up its little bucket with water and food. It drinks frequently, and seems fond of throwing water over its feathers. The male breeds freely with the hen canary, and is assiduous in his attention to her, carrying materials for the nest, and arranging them, and during the time of incubation, regularly supplying her with food.

815 Barbata. *Bearded finch.*—Pale yellow: wings green, spotted with black and red; chin bearded. Size of the canary bird. Inhabits the mountains of Chili, except in winter, when it descends into the plains. It is easily tamed, sings charmingly, and imitates the notes of other birds.

816 Canabina. *Greater redpole, or red-headed linnet.*—Chesnut brown; reddish-white beneath; wings with a longitudinal white band; tail feathers edged with white on each side; bill black; head and neck cinereous; sides yellow; middle of the belly white; tail forked, dusky, both sides edged with white. Head of the female ash-colour, spotted with black; crown and breast without the red; breast dirty yellow with black lines. Subject to considerable variety in the markings. Five inches and a half long. Inhabits Europe and America. These birds fly in flocks during winter, at which time the males have little or none of the red markings, which in the return of spring they put forth. In many parts they haunt the sea shore, and in the breeding season, often resort to furzy commons. The nest is composed of moss and bents interwoven with wool, and lined with wool and hair. The eggs are four or five, of a bluish-white, with purplish specks and short lines. The redpole sings nearly the whole year, is very familiar, and so easily tamed, as to be cheerful in five minutes after it is taken.

817 Linota. *Common or brown linnet.*—Chesnut brown; whitish beneath; wings with a longitudinal white band; tail feathers edged with white on each side. Though this is usually described as a distinct species, it seems to be only a variety of the preceding.

818 Linaria. *Lesser redpole or lesser red-headed linnet.*—Brown, varied with gray; reddish-white beneath; wings with a double white band; crown and breast red; bill and legs brown; back black, the feathers edged with chesnut; sides with narrow dusky lines; quill feathers dusky, edged with dirty white; legs dusky. Female with a saffron spot on the front. Weight about two drams and a half; length

Passeres. length five inches. Inhabits Europe, Asia, and America. It is gregarious in winter, when many are taken by the bird-catchers near London, &c. under the name of *stone redpole*. It breeds in Scotland and the north of England; building in the trunk of the alder a nest of dry sticks and wool, lined with hair and feathers, or willow down. Lays four eggs of a light bluish-green, thickly sprinkled with reddish spots, especially at the larger end.

819 *Montium.* *Mountain linnet*, or *twite*.—Black, varied with reddish; whitish beneath; feathers of the lower part of the neck black in the middle; wings with a white band; rump red; feathers of the throat and breast black, edged with white; middle quill feathers edged; secondary tipt with white. Rather larger than the greater redpole; length about six inches and a half. Inhabits Europe. Is gregarious, and has much the habits of the other linnets, with which it associates.

820 *Coccinea.* *Scarlet finch*.—Bright orange; wings and even tail black; quill feathers orange at the outer edge, the primaries tipt with black; bill brownish; legs black. Four inches and a half long. Inhabits the Sandwich islands.

821 *Domestica.* *House sparrow*.—Quill and tail feathers brown; body gray and black; wings with a single white band; bill black; crown gray; a black spot under each eye; a broad bay mark surrounding the hind part of the head; cheeks white; chin and under side of the neck black, the latter edged with white; lesser wing-coverts bright bay; the last row black, tipt with white. The lower mandible of the female white, and a white line beyond each eye. The most remarkable varieties are, 1. white, 2. yellow, clouded with chesnut above, and 3. blackish. Weighs nearly seven drams; length about six inches. Inhabits Europe, Asia, and Africa. This well known species inhabits the dwellings of the rich and the poor, and is rarely seen far from the habitation of man. It lives on seeds and fruits, and often cunningly avoids the snares that are laid for it. In autumn it is often gregarious, but more frequently so in winter. It does not sing, except when tamed, and then the male will imitate the song of a linnet, or other bird within hearing. It makes a nest conformable to the place which it chooses for incubation, whether in a hole of a wall, in thatch, under the tiles of a house, or in the nest of a martin, or other bird; but when it builds in a tree, the nest is of a large size, and covered at the top, composed of hay and straw, lined warmly with feathers and fragments of thread or worsted, bits of cloth, or any refuse material of that sort found about houses. The female lays six eggs of a whitish colour, spotted with dusky and cinereous, and usually breeds thrice in the year. Mr Smellie relates a pleasing anecdote of the affection of these birds towards their young. "When I was a boy," says he, "I carried off a nest of young sparrows, about a mile from my place of residence. After the nest was completely removed, and while I was marching home with them in triumph, I perceived, with some degree of astonishment, both parents following me at some distance, and observing my motions in perfect silence. A thought then struck me, that they might follow me home, and feed their young according to their usual manner. When just entering the door, I held up the nest, and made the young utter the cry which is expressive of the desire of food. I immediately put the nest and the young in the corner of a wire cage, and placed it on the outside of a window. I chose a situation in the room where I could perceive all that should happen, without being myself seen. The young animals soon cried for food. In a short time both parents, having their bills filled with small caterpillars, came to the cage; and after chatting a little, as we would do with a friend through the lattice of a prison, gave a small worm to each. This parental intercourse continued regularly for some time, till the young were completely fledged, and had acquired a considerable degree of strength. I then took one of the strongest of them, and placed him on the outside of the cage, in order to observe the conduct of the parents after one of their offspring was emancipated. In a few minutes both parents arrived, loaded as usual with food. They no sooner perceived that one of their children had escaped from prison, than they fluttered about, and made a thousand noisy demonstrations of joy both with their wings and their voices. These tumultuous expressions of unexpected happiness at last gave place to a more calm and soothing conversation. By their voices and their movements it was evident that they earnestly entreated him to follow them, and to fly from his present dangerous state. He seemed to be impatient to obey their mandates; but, by his gestures, and the feeble sounds he uttered, he plainly expressed that he was afraid to try an exertion he had never before attempted. They, however, incessantly repeated their solicitations; by flying alternately from the cage to a neighbouring chimney top, they endeavoured to show him how easily the journey was to be accomplished. He at last committed himself to the air, and alighted in safety. Upon his arrival, another scene of clamorous and active joy was exhibited. Next day I repeated the same experiment, by exposing another of the young on the top of the cage. I observed the same conduct with the remainder of the brood, which consisted of four. I need hardly add, that not one either of the parents or children ever afterwards revisited the execrated cage."—Few birds are more persecuted by the farmers, and, perhaps, more unjustly so, than sparrows; as it has been proved, that they are more useful than noxious. Mr Bradley, in his Treatise on Husbandry and Gardening, shows, that a pair of sparrows, during the time that they have their young to feed, destroy, on an average, every week 3360 caterpillars. He discovered that the two parents carried to the nest 40 caterpillars in an hour. He supposed the sparrows to enter the nest only during 12 hours each day, which would cause a daily consumption of 480 caterpillars. This sum gives 3360 caterpillars extirpated weekly from a garden. But the utility of these birds is not limited to this circumstance alone; for they likewise feed their young with butterflies and other winged insects, each of which, if not destroyed in this manner, would be the parent of hundreds of caterpillars.

Tree or *mountain sparrow*, *Hamburgh grosbeak* of Latham, &c.—Quill and tail feathers brown; body gray and black; wings with a double white band; bill, chin, and spot on the ears black; head and nape bay; body above reddish-brown, spotted with black; whitish beneath; wing coverts black, edged with rufous; tail feathers blackish, edged with rufous; legs yellowish. Female without the black spots. Five inches and a half long, and rather smaller than the preceding. Inhabits Europe and North America, and is said to be very plentiful 822 *Montana.*

 tiful in Lincolnshire, Yorkshire, and Lancashire. It is local, and very gregarious.

823 *Ultramarina.* *Ultramarine finch.*—Blue; bill white; legs red. Size of a canary bird. Inhabits Abyssinia, and sings well.

824 Phytotoma.

Gen. 85. Phytotoma.

825 Characters. Bill conical, straight, serrated; nostrils oval; tongue short, and obtuse; feet four-toed.

826 *Rara.* *Rara phytotoma*, or *four-toed plant-cutter.*—Bill thick, half an inch long, and toothed on each side like a saw; irides brown; body ash above; paler beneath; quill and tail feathers spotted with black; tail rounded; hind toe shorter than the fore ones. Inhabits Chili, where it is not uncommon. Has a rough voice, and utters at intervals, the syllable *ra*, *ra*, very distinctly. Feeds on vegetables, digging and cutting about their roots with its bill as with a saw, and thus making great havock in gardens. Builds in lofty trees, in retired situations.

827 Muscicapa.

Gen. 86. Muscicapa, *Fly-catcher.*

828 Characters. Bill nearly triangular, notched on each side, bent in at the tip, and beset with bristles at the root; toes in most cases divided to their origin.

The birds of this genus live on insects, particularly flies. Of 92 species, two only inhabit Britain.

829 *Paradisi.* *Paradise fly-catcher*, or *pied bird of Paradise.*—Crested; head black; body white; tail wedged; two middle feathers very long; head, neck, and chin greenish-black; back, rump, throat, and body white beneath; wing coverts and quill feathers black, edged with white; two middle tail feathers 15 inches long; legs lead-coloured. Eight inches and a quarter long. Of this species there are several varieties. Inhabits Asia and Africa.

830 *Tyrannus.* *Forked-tail fly-catcher.*—Tail very long and forked; body black; white beneath. Fourteen inches long. Inhabits Canada and Surinam.

831 *Malachura.* *Soft-tailed fly-catcher.*—Brown; ferruginous beneath; throat of the male blue; tail long, wedged, with loose webbed feathers. Inhabits New Holland, being found about Sidney and Botany Bay, in marshy places, abounding with long grass and rushes, which afford it a hiding place, and where, like the bearded titmouse, it is supposed to make its nest. When disturbed, its flight is very short; but it runs on the ground with great swiftness. This singular bird, which is but three inches long, is well represented in the fourth volume of the Linnæan Transactions.

832 *Pygmaea.* Plate CCCCI. fig. 4. *Dwarf fly-catcher.*—Straw-coloured beneath; head and neck rufous, spotted with black; feathers of the back and wing coverts cinereous; edged with greenish; quill feathers black, edged with gray; tail black and short. Hardly three inches long. Inhabits Cayenne.

833 *Rubricollis.* *Purple-throated fly-catcher.*—Black; chin and throat with a large purple red spot. Twelve inches long. Inhabits woods in South America, is gregarious, feeds on fruits and insects, and often associates with the toucan.

834 *Atricapilla.* *Pied fly-catcher.*—Black above; under parts, spot on the front, and shield on the wings, white; lateral tail feathers white without; bill and legs black; tail coverts spotted with white. Female brown; white beneath, and wants the frontal spot. About the size of a linnet, and nearly five inches long. There are three or four varieties, and the young birds at first resemble the female. It is local, and by no means plentiful in this island, affecting wild and uncultivated tracts of furze. According to Dr Latham, it builds in some hole of a tree, not very near the ground, making a nest of a few fibres, mixed with moss, and laying six eggs.

Chattering fly-catcher.—Green; yellow beneath; belly and vent whitish; eyebrows and spot under the eyes whitish; tail brown. Seven inches and three quarters long. Haunts unfrequented places in Carolina; is very shy, and flies with its legs extended. 835 *Viridis.*

Azure fly-catcher.—Blue; hind head and breast with a black spot; belly and vent bluish-white; quill and tail feathers dusky-blue. Five inches long. Inhabits the Philippine islands. 836 *Caerulea.*

Fan-tailed fly-catcher.—Olive above, ferruginous beneath; eyebrows, chin, throat, sides of the neck, and lateral tail feathers white; middle tail feathers, head, and collar black. Six inches and a half long. Inhabits New Zealand. Flies with its tail expanded like a fan; and is easily tamed. 837 *Flabellifera.*

Black fly-catcher.—Totally black; bill, head, and legs dusky black. Inhabits Society islands. 838 *Nigra.*

Active fly-catcher.—Olive-brown; whitish beneath; quill and tail feathers black, and edged with olive-brown. Four inches and a half long. Inhabits Cayenne. Is continually hunting after insects, which it picks out from under the bark of trees. 839 *Agilis.*

Spotted fly-catcher.—Brownish whitish beneath; neck longitudinally spotted; vent pale-rufous; bill black, whitish at the base; inside of the mouth yellow; head large, brownish, and spotted with black; back mouse-coloured; wings and tail black; the former edged with white; chin spotted with red; legs black. About the size of the tit-lark; length five inches and a half. Inhabits Europe. This bird visits us in spring, and departs in September. It frequents orchards and groves, and will make its nest on the limb of some fruit-tree nailed against the wall, or in a hole, sometimes in out-buildings, on the end of a beam or rafter, and at other times against the body of a large tree, on the stump of a decayed branch. The nest is formed of bents, moss, and such materials, interwoven with spiders webs, and lined with feathers. The female lays four or five eggs, not much unlike those of the redbreast, but rather less, and the rust-coloured spots more distinct, and not so much confined to the larger end. Its food seems to be entirely winged insects, though it is said to be particularly fond of cherries, probably from the circumstance of its frequenting the cherry tree for the sake of flies that are attracted by the fruit. As soon as the young birds leave the nest, they are led by the old ones to some neighbouring wood or grove where insects abound, and where they may be seen darting in every direction in pursuit of flies, and frequently returning to the same station. The note of this species is a simple weak chirp, not frequently used till after the young are fled, so that the bird, though not uncommon, is not readily discovered. 840 *Grisola.*

Desert fly-catcher.—Body ferruginous and sooty; wings and tail blackish; bill yellowish. Inhabits the deserts of Arabia. 841 *Deserti.*

Gen.

Passeres.

Gen. 87. Motacilla.

842 Motacilla. Bill subulated, straight; the mandibles nearly equal; nostrils obovate; tongue lacerated at the end.

843 Characters. Most of this genus feed on insects; a few are gregarious; and on the approach of winter, migrate to warmer climates.

844 Luscinia. *Nightingale.*—Rufous-ash, white-ash beneath; tail feathers rufous-brown; bracelets cinereous; bill brown; head and back pale mouse-colour, with olive spots; tail red-mouse colour; legs and quill feathers brown-ash, the latter chesnut on the outer edge. About the size of the sky-lark, but of a more slender and elegant form. Weighs six drams; and measures between six and seven inches in length. There is a variety with the body somewhat larger, and another that is entirely white. Inhabits Europe, Asia, and Africa. Appears in England sometimes in April, but most commonly not till the beginning of May. The females do not arrive till a week or ten days after the males; so that on the first arrival of these birds none but males are caught, a circumstance which has given rise to the supposition, that the proportion of males exceeds that of females. The nightingale is said to be found as far north as Yorkshire, and certainly not farther west than the eastern borders of Devonshire; it is plentiful both in Somersetshire and Dorsetshire. This bird resides wholly in woods and thickets, and is seldom seen. About the latter end of May it prepares a nest of dry leaves, generally of the oak, and lined with dry grass, usually placed on the ground, among the same materials of which it is composed, so that it is not readily discovered. The eggs are four or five, of an uniform brown colour, and rather larger than those of the hedge-sparrow. As soon as the young are hatched, the song of the nightingale ceases; and it is a mistaken notion that this, or any of the later breeding birds, have a second brood in the same season, except when some accident has befallen the first. The young are not easily reared in confinement. At first they are fed with meal-worms, and afterwards with boiled sheep's heart. The winter residence of this bird is said to be in Asia. The sweetness and variety of its notes have been universally admired, and the more so, perhaps, because they are uttered in the silence of night. In a wild state, it does not sing above ten weeks in the year, while those confined in a cage continue their song for nine or ten months. The honourable Daines Barrington once kept a very fine nightingale for three years, during which time he paid particular attention to its song. Its tone was infinitely more mellow than that of any other bird, though at the same time, by a proper exertion, it could be very brilliant. When it *sung its song round*, in its whole compass, he observed sixteen different beginnings and closes; at the same time that the intermediate notes were commonly varied in their succession with so much judgment as to produce the most pleasing variety. Sometimes it would continue its song twenty seconds without a pause; whenever respiration, however, became necessary, it was taken as skilfully as by an opera singer. Nightingales will also adopt the notes of other birds, may be instructed to sing by turns, with a chorus, and even to articulate words. The London bird-catchers take them by net-traps, baited with meal-worms from the bakers shops. It is with great difficulty that the old birds are induced to sing after being taken; for a considerable time they refuse to eat; but by great attention to their treatment, and avoiding every thing that might agitate them, they at length resume their song, and continue it during the greater part of the year.

Hang-nest warbler.—Greenish-brown above, tawney beneath; ocular line, and one beneath, black. Size of a robin-redbreast. Inhabits Jamaica, and builds a hanging nest. 845 Calidris.

Hedge-sparrow, or *hedge-warbler.*—Gray-brown above; wing-coverts tipt with white; breast bluish-ash; bill blackish; cheeks striped with white; feathers of the back and wing-coverts edged with chesnut; wings and tail dusky; rump greenish brown; chin and breast cinereous; belly whitish; vent yellowish; legs flesh-coloured Length five inches and three quarters; weight nearly six drams. Inhabits Europe; and is one of the few of the warbler tribe that remains with us the whole year. It has a pleasing plaintive song, which it begins with the new year, if the weather is mild, breeds early, making, in March, a nest composed of green moss and wool, and lined with hair, which is placed in some low evergreen shrub, thick bush, or cut hedge, and sometimes in faggot piles. The female lays four or five blue eggs. In default of insects and worms, the hedge-sparrow will pick up crumbs of bread, and seems to prefer situations near the habitation of man. The cuckoo frequently makes choice of this bird's nest for the purpose of depositing its egg. 846 Modularis.

Lesser petty-chaps.—Greenish-ash above, yellowish beneath; belly whitish; limbs brown; eyebrows whitish; upper mandible black, lower bluish; inside of the mouth red; a yellowish line above and beneath the eyes; quill and tail feathers mouse-coloured, and edged with greenish; the shafts black; lower wing-coverts yellow; belly silvery. Weight about two drams; length rather more than four inches and a half; size inferior to that of the yellow wren, which it much resembles in plumage, and with which, and the wood-wren, it has been often confounded. It is the first of the warblers that visits us in the spring, being generally heard on or before the first of April, repeating its song, if so it may be called; for it consists only of two notes, which seem to express the words *chip*, *chop*, four or five times successively. It is a busy, restless bird, always active among the trees and bushes, in search of insects. The nest is oval, with a small hole near the top, composed externally of dry leaves and coarse dry grass, and lined with feathers. For the most part, it is placed on, or near the ground, frequently on a ditch-bank, or in a tuft of grass or low bush. The eggs are five or six, white, speckled with purplish-red at the larger end only, with here and there a single speck on the sides. This species is found in almost every part of the country where wood or hedges can shelter it. Its note is heard long after the yellow wren is silent; and it remains with us, not unfrequently, till the latter end of October. 847 Hippolais.

Wood-wren.—Olive-green above; throat and cheeks yellow; belly and vent fine silvery; tail feathers brown, and, except the first, green on the outer webs, and white on the inner; bill horn-colour; irides hazel; breast pale-yellow; a yellow line through the eye; tail somewhat forked, and brown; under part of the shoulder bright yellow; legs horn-colour. Weight about two drams 848 Sylvatica.

Passeres. drams and forty grains; length five inches and a quarter. The female is rather larger. This is a migrative species, appearing about the end of April, and departing in September. The females arrive ten days or a fortnight after the males. From its great similitude to the yellow wren, it has been little noticed as a distinct species, but is far from uncommon in some parts of England. It seems partial to oak and beech woods, where it may be found by its singular note, expressive of the word *twee*, drawn out to some length, and repeated five or six times in succession, terminating with the same notes, delivered in a hurried manner, and accompanied by a shaking of the wings. The nest, which is oval with a small hole near the top, is constructed of dry grass, a few dead leaves, and a little moss, and is invariably lined with finer grass and a few long hairs. It is placed on the ground, and contains six white eggs, sprinkled all over with purplish spots.

849 *Hortensis.* *Petty-chaps*, or *greater petty-chaps*.—Gray-brown above, white beneath; eyebrows whitish; quill feathers brown-ash, edged with gray, the outmost on the outer web, and near the tip on the inner, whitish; bill blackish; lateral tail feathers edged with gray-brown; legs brown. Length six inches; weight about five drams. Inhabits Europe; and occurs during summer in Lancashire, and in some of the southern counties of England. It chiefly frequents thick hedges, where it makes a nest composed of goose-grass, and other fibrous plants, flimsily put together, with sometimes an addition of a little green moss externally. It usually contains four eggs, about the size of the hedge-sparrow's, of a dirty white, blotched all over with light brown, especially at the larger end, where spots of ash-colour also appear. The song of this species is little inferior to that of the nightingale. Some of the notes are sweetly and softly drawn, others quick, lively, loud, and piercing, reaching the distant ear with pleasing harmony, not unlike the blackbird's whistle, but in a more hurried cadence. It frequently sings after sunset.

850 *Salicaria.* *Sedge warbler*.—Cinereous above, white beneath; eyebrows white; bill black; head brown, with dusky streaks; hind part of the neck and back reddish-brown; back spotted with black; tail coverts tawney; wing-coverts dusky, edged with pale brown; tail brown and wedged; legs dusky. Weight about three drams; length five inches and a half. Inhabits sedgy situations in Europe. It comes to us about the middle of April, and leaves us again in September. It has a variety of notes, which it utters in a hurried manner, and which partake of those of the sky-lark and swallow, as well as of the chatter of the house-sparrow. It is frequent by the sides of rivers and watery places, where sedges and reeds grow, among which it makes a nest, composed of a little moss, intermixed with dry stalks, and lined with dried grass, and occasionally a few hairs, sometimes fastened between two or three reeds, sometimes placed on a tuft of rushes, and fastened round the bottom of them, and at other times, in a low bush, or on the trunk of a willow. The eggs are five or six, of a light-brown colour, mottled with darker shades of the same. Various authors have erroneously ascribed the song of this warbler to the reed-bunting, which has no notes that deserve the name of song, a mistake which has originated from both species breeding in the same places, and the reed-bunting being conspicuous on the upper branches of a tree, while the little warbler, concealed in the thickest part, is heard aloud. It has been remarked, that if it be silent, a stone thrown into the bush, will make it begin singing instantly, and that it will also sing during a moon-light night.

White-throat.—Cinereous above, white beneath; first tail feathers longitudinally half-white, the second tipt with white; bill black, white at the base; head brownish-ash; back reddish. Female, with the breast and belly snowy. There is a variety that is reddish-ash above, and reddish-white beneath, with the throat white; the outmost tail feathers on the upper part of the inner side, and whole of the outer side white. Weight about four drams; length five inches and three quarters. Inhabits Europe, and is very common in our inclosed countries. It arrives about the middle of April, and enlivens our hedges with its song, when it erects the feathers on the crown of the head. The nest is made of goose-grass, lined with fibres, and sometimes a few long hairs, but is of so flimsy a texture that it can afford little warmth to the eggs or young. It is generally placed in some low bush, among nettles or other luxuriant plants. The eggs are four or five, of a greenish-white, and speckled all over with light brown or ash-colour. The white-throat feeds on insects and berries, and frequents our gardens in the summer, for the sake of cherries and currants. 851 *Sylvia.*

Lesser white-throat.—Brown-ash, dirty-white beneath; two middle tail feathers shorter and subulated; bill dusky, the base beneath yellowish; irides dusky; crown deeper than the body; legs brown. Scarcely five inches long. Though not so common as the preceding, it occurs in many of the hedges of Gloucestershire and Wiltshire; builds in low shrubs, and has a shrill whistling note. 852 *Sylviella.*

Epicurean warbler.—Brownish, white beneath; breast spotted with cinereous. About five inches long. Inhabits Europe. Its flesh is reckoned delicious. 853 *Ficedula.*

Dartford warbler.—Chesnut above, ferruginous beneath; middle of the belly, edge of the quill feathers, spurious wings, and outside of the outmost tail feather white; eyebrows red; bill black, the base beneath white; irides scarlet; tail black, and as long as the body; legs yellow. Inhabits Provence, and rarely England. A pair were shot on a common near Dartford in 1773, and others have since been observed about Falmouth, Wandsworth, &c. As yet the nest and eggs are unknown. It is rather larger than the common wren, and five inches and a half in length. It is a shy bird, concealing itself among the thickest furze, on the least alarm, and creeping from bush to bush. The shortness of the wing, and length of tail give it a singular manner of flying, which is in short jerks, with the tail thrown up. Its note is a weak but shrill piping noise, several times repeated. 854 *Provincialis.*

Pensile warbler.—Gray, yellow beneath; belly and eyebrows white; lores spotted with yellow; wing coverts with alternate white and black bands. Nearly five inches long. Inhabits St Domingo, and some of the West India islands, where it feeds chiefly on insects and fruits; and has a very delicate song, which is continued throughout the year. "The sagacity displayed by this bird (says Mr Bingley), in building and placing its nest, is truly remarkable. She does not fix it at the forking of the branches, as is usual with most other birds, 855 *Pensilis.*

birds, but suspends it to binders hanging from the netting, which she forms from tree to tree, especially those which fall from branches that hang over the rivers and deep ravines. The nest consists of dry blades of grass, the ribs of leaves, and exceedingly small roots interwoven with the greatest art; it is fastened on, or rather it is worked into, the pendant strings. It is in fact a small bed rolled into a ball, so thick and compact as to exclude the rain; and it rocks in the wind without receiving any harm. But the elements are not the only enemies against which this bird has to struggle; with wonderful sagacity it provides for the protection of its nest from other accidents. The opening is not made on the top nor side of the nest, but at the bottom. Nor is the entrance direct. After the bird has made its way into the vestibule, it must pass over a kind of partition, and through another aperture before it descends into the abode of its family. This lodgment is round and soft, being lined with a species of lichen, which grows on the trees, or with the silky down of plants."

856 *Alba.* *White* or *water wagtail;* provincially, *dishwasher*, or *washerwoman.*—Breast black; two lateral tail feathers obliquely half white; bill, hind head, nape, throat, and legs black; front, orbits, sides of the neck, and belly white; body cinereous above; greater quill feathers blackish; secondary, and wing-coverts dusky, and edged with gray; middle tail feathers black, and edged with gray. Female with the crown brown. Weight nearly six drams; length seven inches and a half. This species inhabits almost every where; is a very active bird, and continually in motion, running after flies. In this country, as the weather becomes severe, it is apt to haunt marshes that are subject to the flow of the tide. Early in spring they return to their usual summer situation; and from the number which are sometimes seen together at this time attending sheepfolds and newly ploughed fields, we may presume that they are gregarious in their flights. In the breeding season they seem to prefer pleasure grounds that are constantly mowed, on which they run unencumbered, and where the insects have not sufficient cover to evade their sight. The nest is found in various places, sometimes on the ground, in a heap of stones, the hole of a wall, or on the top of a pollard tree. It is composed of moss, dried grass, and fibres, put together with wool, and lined with feathers or hair. The eggs are four or five, white, and spotted all over with light brown and ash-colour; weighing about forty grains, and much resembling that of the cuckoo, which bird frequently makes choice of the wagtail's nest, in which to deposit her egg. It sings very prettily early in spring, and frequently gives the alarm on the appearance of a hawk, which it pursues in company with the swallows. The young birds have no black on the throat till the returning spring, and the old ones lose it in winter. In this state they have been erroneously described as a variety.

857 *Flava.* *Yellow wagtail.*—Breast and belly yellow; two lateral tail feathers obliquely half white; bill and legs black; hind claw very long; body olive above; band through, and one beneath the eyes, black; throat with a few black spots; middle and greater wing-coverts black, edged with yellowish; tail black. Female with whitish eyebrows. Length six inches and a half. Inhabits Europe and Asia. Visits this country in April, and departs in September. It frequents arable land, especially in the more champaign parts, and sometimes uncultivated ground, interspersed with furze. It is also partial to bean fields; and breeds in all such situations, being more negligent of water than the white or gray wagtail. The nest is always placed on the ground, composed of dried stalks and fibres, and lined with hair. The eggs are four or five; not very unlike those of the sedge warbler. Its note is more shrill than that of the white, and less so than that of the gray wagtail.

858 *Oenanthe.* *Wheatear.*—Back hoary; front, line above the eyes, rump, and base of the tail white; a black band through the eyes; crown, neck, and back reddish-gray; eyebrows, rump, upper tail coverts, and upper half of the tail white; lower half, legs, and quill feathers black, the latter edged with reddish-brown; body yellowish-white beneath. The female wants the line over the eyes. There are, however, several varieties. Weighs about six drams and a half; length near six inches and a half. Inhabits Europe, Asia, and Africa. This bird visits England annually in the middle of March, and leaves it again in September. In some parts they are found in great plenty, and are much esteemed. About Eastbourne in Sussex, they are taken in snares made of horse-hair, placed beneath a long turf. Being naturally very timid, the motion even of a cloud, or the appearance of a hawk, will immediately drive them into the traps. These last are first set, every year on St James's day, the 25th of July; soon after which they are caught in astonishing numbers, considering that they are not gregarious, and that more than two or three are scarcely ever seen flying together. The number annually ensnared in the district of Eastbourne alone, is said to amount to nearly two thousand dozen. The birds caught are chiefly young ones; and they are invariably found in the greatest number when an easterly wind prevails. They are very fat in autumn, and esteemed a great delicacy, little inferior to the ortolan. They live chiefly on insects and earth worms, frequent open stony places, warrens, downs, &c. and breed in stone walls, old rabbit holes, or under stones, making a large nest of dry grass, rabbit's down, feathers, and horse-hair. The female lays five or six eggs, of a uniform pale-blue colour. The wheatear sings prettily, and not unfrequently on wing, hovering over the female.

859 *Rubetra.* *Whinchat.*—Blackish; eyebrows white; wings with two white spots; chin and breast yellowish; bill and legs black; chin white; tail white; the lower third part blackish; two middle feathers all blackish. Weighs about four drams and a half; length full five inches. Inhabits Europe, and appears in this island about the middle of April, frequenting the same places with the stonechat, and corresponding with it in most of its habits.

860 *Rubicola.* *Stonechat*, or *moor titling.*—Gray, pale rufous beneath; throat with a white band; lores black; bill and legs blackish; head and neck nearly black; body above blackish, varied with pale rufous; breast and belly reddish yellow; vent and rump white; tail feathers black, the two outmost, on the outer edge and tip, pale ferruginous; quill feathers black, edged with ferruginous; those next the body at the base, and wing-coverts, with a white spot. Female varied with blackish and reddish. Weight about five drams; length five inches and a quarter. Inhabits hedges and dry moors in Europe and Siberia. Feeds on insects and worms, and frequently

Passeres. ly sits on the uppermost sprays, darting at every fly that passes. The nest is placed on, or very near the ground, at the bottom of a furze bush, or some similar situation, is composed of moss and bents, lined with hair, and sometimes mixed with small feathers. The eggs are five, of a blue colour, with small rufous spots at the larger end. When the young leave the nest, the old birds are extremely bold and clamorous, and are as artful in enticing any one from their young as they are in concealing their nest. In the early part of the spring, the stonechat sings very prettily, springing into the air, and suspending itself for some time on wing. But as it breeds so early, its song is of short duration.

861 Atricapilla. *Blackcap.*—Brick-colour above, cinereous beneath; cap dusky-black; bill brown; crown black, in the female chesnut; body greenish-ash above, gray beneath, gradually growing white; temples gray; quill and tail feathers brown-ash, edged with greenish-ash, the middle ones very short; legs lead colour. Of this species there are at least three or four varieties. Length full six inches. Inhabits Europe. It is a migrative bird, visiting us early in the spring and retiring in September. It frequents woods and thick hedges, and seems very partial to orchards and gardens, where it delights us with its charming melodious song, which is very little inferior to that of the nightingale, except in variety of notes. It makes a nest in some low bush or shrub, composed of dried stalks, generally of goose-grass, put together with a little wool, and sometimes a little green moss on the outside, and lined with fibrous roots, on which are frequently placed a few long hairs. The eggs are four or five, of a pale reddish-brown, mottled with a deeper colour, and sometimes sprinkled with a few ash-coloured spots. On the first arrival of this bird it feeds greedily on ivy berries, but forsakes that food as soon as the vernal sun has roused the insect tribe.

862 Spinicauda. *Thorn-tailed warbler.*—Chesnut, white beneath; crown spotted with yellow; face and eyebrows yellow; wing coverts rufous, varied with brown; the greater and quill feathers brown; tail wedged, the feathers daggered. Four inches and a half long. Inhabits Terra del Fuego.

863 Minima. *Least warbler.*—Pale brown, whitish beneath; bill and very short tail yellowish. Three inches long. Inhabits New Holland.

864 Phœnicurus. *Redstart.*—Throat black; belly and tail rufous; head and back hoary; front white; bill, cheeks, and legs, black; belly white; rump, breast, and lateral tail feathers rufous; the middle ones brown; wings brown. Female with the crown and back gray-ash; and chin white. Five inches and a quarter long. Inhabits Europe. It is seen in this country only in spring and summer. It builds in holes of walls, or even of houses, or in hollow trees; and lays four or five eggs. It sings prettily, and imitates the notes of other birds. It is less than the redbreast, and moves its tail horizontally.

865 Suecica. *Blue-throated warbler.*—Breast ferruginous, with a blue band; tail feathers brown, ferruginous towards the tip. Size of the redbreast. Inhabits Europe and Siberia. Sings sweetly, and does not migrate.

866 Cyanea. *Superb warbler.*—Black blue above, white beneath; feathers of the head long, lax, and turgid; front, cheeks, and lunule on the neck fine blue. Five inches and a half long. Inhabits New Holland.

867 Arundinacea. *Reed wren.*—Olive-brown above, whitish beneath; lores and orbits whitish-brown; band in the middle of the wings tawney-yellow beneath; tail brown, slightly wedged; under part of the toes greenish-yellow. Upper mandible horn-colour, lower flesh-colour; mouth orange; irides brown; chin white; legs pale-olive. Length scarcely five inches and a half; weight nearly three drams. Has often been confounded with the sedge warbler, to which it is nearly allied in form, size, and habits; but it may at once be distinguished by the greater broadness of the base of the bill, by the want of a light stroke over the eye, and having the upper parts of one plain colour. The nest and eggs are also different. The former is composed of long grass, and the seed-branches of reeds, and lined with the finer parts of the latter. It is very deep, and is generally fastened by long grass to several reeds, which are drawn together for that purpose. The eggs are four or five, rather larger than those of the sedge-warbler, of a greenish-white, blotched all over with dusky brown. This species inhabits near Uxbridge, in the fens of Lincolnshire, and in many parts of the south of England and Wales; arriving about the end of April, or beginning of May, and departing again in September.

868 Rubecola. *Redbreast*, or *robin redbreast.*—Gray; throat and breast ferruginous; bill and legs dusky; tail feathers terminating in an acute angle; belly white; edges of the quill feathers inclining to yellow. There is a variety with a white chin; wing-coverts varied with white, black, and rufous; quill and tail feathers black, and edged with rufous; and another that is entirely white. This well-known species is a constant inhabitant of most parts of the European continent, and appears about our dwellings in winter, when the woods and fields are destitute of insects. "When the cold grows more severe (says Buffon), and thick snow covers the ground, it approaches our houses, and taps on the window with its bill, as if to entreat an asylum, which is cheerfully granted; and it repays the favour by the most amiable familiarity, gathering the crumbs from the table, distinguishing affectionately the people of the house, and assuming a warble, not indeed so rich as that of the spring, but more delicate. This it retains through all the rigours of the season; to hail each day the kindness of its host, and the sweetness of its retreat. There it remains tranquil till the returning spring awakens new desires, and invites to other pleasures: it now becomes uneasy, and impatient to recover its liberty." The redbreast generally builds its nest by the roots of trees, in some concealed spot near the ground, composing it of dried leaves mixed with hair and moss, and lined with feathers. The female lays from five to seven eggs, which are whitish, and spotted with rust-colour, and cinereous. In order the more successfully to conceal its nest, we are told, that it covers it with leaves, suffering only a narrow winding entrance under the heap to be left. This bird feeds principally on insects and worms: and its delicacy in preparing the latter is somewhat remarkable. It takes a worm by one extremity, in its beak, and beats it on the ground, till the inner part comes away; then taking it in the same manner by the other end, it cleanses the outer part, which alone it eats. Besides insects, it is fond of the seeds of the spindle tree. It is a solitary and quarrelsome species, insomuch that two are never seen on the same tree.

869 Troglodytes. *Wren.*—Gray; eyebrows white; wings waved with black

Passeres. black and cinereous; bill dark green; head and body deep reddish brown above; quill feathers alternately barred with black and red; throat yellowish-white; belly and sides crossed with narrow, dusky, and pale reddish-brown lines; tail with dusky bars; legs brownish. Length nearly four inches and a quarter; weight about two drams and three quarters. Inhabits Europe and Asia. Its nest is curiously constructed, and not begun at the bottom, as is the case in most instances, but first traced, as it were, in oval frame-work, and equally fastened in all its parts to a tree, or other support, and afterwards inclosed on the sides and top, a small hole only being left near the latter, for entrance. If the nest is placed under a bank, the top is first begun, and well secured in some small cavity by which the fabric is suspended. The materials are generally adapted to the place; if built against the side of a hay-rick, for example, the nest is composed of hay, if against the side of a tree covered with lichen, it is made of that species of moss, &c. The lining is invariably feathers. The eggs are seven or eight, and sometimes more, white, and sparingly marked with small reddish spots. The song of the wren is much admired, being, though short, a very pleasing warble, and louder than could be expected from the size of the bird. This it continues throughout the year; and it has been heard to sing, with apparent unconcern, even during a fall of snow. It also sings very late in the evening, though not like the nightingale, after dark. The wren feeds on insects, which it finds in sufficient abundance to support life, even in the severest winters.

870 Regulus. *Golden-crested wren.*—Greenish; secondary quill feathers yellow on the outer edge, and white in the middle; crown orange; bill black; crest orange (of the female yellow), each side edged with black; body yellowish-green above, reddish white beneath; wing-coverts dark brown, with two transverse white bars; legs yellow. Inhabits every quarter of the globe. This is the smallest British bird; its weight seldom exceeding eighty grains, and its length three inches and three quarters. It migrates from the Shetland islands in winter, but continues in the Orkneys the whole year. Its song is like that of the common wren, but its voice is weaker. It builds a nest nearly of a round form, with a hole in the side; and lays from six to eight eggs. It erects or depresses the crest at pleasure. Though not uncommon, it often escapes observation, from the smallness of its size. It has also been remarked, that the female, from some cause which has not yet been discovered, is frequently destroyed during the time of incubation; and the nest, with the eggs, left to decay. Mr Montagu communicates the following interesting details relative to a young family of this beautiful species. "When first I discovered the nest, I thought it a favourable opportunity to become acquainted with some of the manners of this minute species, and to endeavour to discover whether the male ever sung by way of instructing the young ones. Accordingly I took the nest when the young were about six days old, placed it in a small basket, and by degrees enticed the old ones to my study window; and after they became familiar with that situation, the basket was placed within the window; then at the opposite side of the room. It is remarkable, that although the female seemed regardless of danger from her affection to her young, yet the male never once ventered within the room; and yet would constantly feed them while they remained at the outside of the window; on the contrary, the female would feed them at the table at which I sat, and even when I held the nest in my hand, provided I remained motionless. But on moving my head one day, while she was on the edge of the nest, which I held in my hand, she made a precipitate retreat, mistook the open part of the window, knocked herself against the glass, and laid breathless on the floor for some time. However, recovering a little, she made her escape, and in about an hour after I was agreeably surprised by her return, and would afterwards frequently feed the young while I held the nest in my hand. The male bird constantly attended the female in her flight to and fro, but never ventured beyond the window-frame; nor did he latterly ever appear with food in his bill. He never uttered any note but when the female was out of sight, and then only a small chirp. At first there were ten young in the nest, but probably for want of the male's assistance in providing food two died. The visits of the female were generally repeated in the space of a minute and a half or two minutes, or upon an average, thirty-six times in an hour; and this continued full sixteen hours in a day, and which, if equally divided between the eight young ones, each would receive 72 feeds in the day; the whole amounting to 576. From examination of the food, which by accident now and then dropt into the nest, I judged from those weighed that each feed was a quarter of a grain upon a medium; so that each young one was supplied with 18 grain weights in a day; and as the young birds weighed about 77 grains at the time they began to perch, they consumed nearly their weight of food in four days at that time. I could always perceive by the animation of the young brood when the old one was coming; probably some low note indicated her near approach, and in an instant every mouth was open to receive the insect morsel. But there appeared no regularity in the supply given by the parent bird; sometimes the same was fed two or three times successively; and I generally observed that the strongest got most, being able to reach farthest, the old one delivering it to the mouth nearest to her, and after each feed she waited a while to see if any *muted*."

Yellow wren.—Dusky green above, yellowish-white beneath; wings and tail brown, and edged with green; 871 Trochilus. eyebrows yellow. Four inches and a half long. Inhabits Europe and America. Frequents wooded and inclosed situations, especially where willows abound. Visits us early in April, and soon begins its usual song, which is short, with little variety. Makes an oval nest, with a small opening near the top, composed of moss and dried grass, and lined with feathers, either in the hollow of a ditch, or in a low bush, close to the ground. The eggs are six or seven, white, and spotted with light rust colour. Has often been confounded with the lesser prettychaps, and the wood wren.

Tailor warbler, or *tailor bird*.—Entirely yellow, and 872 Sutoria. very small, scarcely exceeding three inches in length. Inhabits India. Its nest is composed of two leaves, the one generally dead, which it fixes, at the end of some branch, to the side of a living one, by sewing both together with little filaments (its bill serving as a needle), in the manner of a pouch or purse, and open at the top. Sometimes, instead of a dead and a living leaf, two living

Passeres. ing ones are sewed together, and, when thus connected, seem rather the work of human art than of an uninstructed animal. After the operation of sewing is finished, the cavity is lined with feathers and soft vegetable down. The nest and birds are together so very light, that the leaves of the exterior and more slender twigs of the trees are chosen for the purpose; and, thus situated, the brood is completely secured from the depredations of every invader.

873 Boarula. *Gray wagtail.*—Cinereous above, yellow beneath; first tail feathers entirely, second on the inner side, white; bill and legs brown; chin and throat black; wing-coverts brown, and edged with ash; quill feathers brown, the secondaries white at the base; middle tail feathers black, and edged with greenish. Weighs about five drams; and measures seven inches and three quarters in length. This elegant species inhabits Europe; visits us about the latter end of September, and departs in April. It is much in motion, constantly flirts the tail, seldom perches, frequents waters, makes its nest on the ground, and sometimes on the banks of rivulets, and lays from six to eight eggs, of a dirty white, marked with yellow spots.

874 Pipra.

Gen. 88. Pipra, *Manakin.*

875 Characters. Bill shorter than the head, hard, nearly triangular at the base, and slightly incurved at the tip; nostrils naked; feet gressorial; tail short.

876 Rupicola. Plate CCCCII. fig. 4. *Crested* or *rock manakin.*—Crest erect, edged with purple; body saffron; tail coverts truncated.—Size of a small pigeon; from 10 to 12 inches long; is shy, but may be tamed, if taken young; feeds on small wild fruits, and builds in the clefts of the most remote rocks, laying two white eggs. Inhabits the rocky parts of South America.

877 Manacus. *Black-capped manakin.*—Black above, white beneath; spot on the neck above, and on the wings, white; bill black; legs yellow. Inhabits the woods of Guiana. Is restless and gregarious.

878 Minuta. *Little manakin.*—Gray; head black, speckled with white. Size of a small wren. Inhabits India.

879 Musica. *Tuneful manakin.*—Black above, orange beneath; front and rump yellow; crown and nape blue; chin and throat black. Four inches long. Inhabits St Domingo. Is very shy, and easily eludes the vigilance of such as attempt to take it. Its note is musical, and forms a complete octave, one note succeeding another.

880 Parus.

Gen. 89. Parus, *Titmouse.*

881 Characters. Bill very entire, narrow, somewhat compressed, strong, hard pointed, and covered at the base with bristles; tongue truncated, and bristly at the end; toes divided at the origin, the hind ones large and strong.

This is a numerous and prolific tribe, some of the species laying from 18 to 20 eggs at a time. Most of them feed on seeds, fruits, and insects, and some on flesh. They are particularly fond of the brains of other birds, which they get at by cleaving the skulls of such as they find dead. They are restless, bold, cruel to birds less than themselves, and will attack such as are three times their own size. Their note is generally unpleasant.

882 Cristatus. Plate CCCCI. fig. 5. *Crested titmouse.*—Head crested; collar black; belly white. Nearly five inches long. Inhabits Europe, chiefly in fir woods. Is solitary, and not easily tamed.

Great titmouse, or *ox-eye.*—Head black; temples white; nape yellow; bill, chin, and tail black; back and wings olive; rump blue gray; belly greenish yellow, divided in the middle by a band of black, extending to the vent; quill feathers dusky, edged partly with blue, partly with white; exterior sides of the outmost tail feathers white, of the others bluish; inner sides dusky; legs lead-coloured. This species weighs about 10 drams; length five inches and three quarters. It inhabits Europe, Asia, and Africa; and is common in many parts of Britain, frequenting gardens and orchards, where it does much mischief by picking off the tender buds of trees. The nest is made of moss, lined with hair, and placed in the hole of a wall, or of a tree. The female sometimes lays eight or ten eggs, but more commonly six, which are white, spotted with rust-colour, and so exactly like those of the nuthatch, as not to be distinguished from them. The common note of the great titmouse is a sort of chatter; but in the spring it assumes a greater variety, a shrill whistle, and a very singular noise, something like the whetting of a saw: but these cease with incubation. A variety was once killed near Feversham in Kent, that had the bill crossed, as in *loxia curvirostra*. Its characters were olive brown above; dirty yellowish beneath; head black; temples cinereous, and bill forked. 883 Major.

Creeping titmouse.—Bluish; temples, breast, and back yellowish; flanks purplish. Four inches and three quarters long. Inhabits Carolina and Canada. Is constantly running up and down trees in search of insects. 884 Americanus.

Blue titmouse, or *tomtit.*—Quill feathers bluish, the primaries white on the outer edge; front white; crown blue; bill blackish; line from the bill to the eyes, and one surrounding the temples black; back yellowish-green; wing coverts blue; quill feathers black, with dusky edges; tail blue, the middle feathers longer; body whitish-yellow beneath; legs and claws black. Length about four inches and a half; weight three drams. Inhabits Europe. This species would probably be more admired for its beauty, if it was less common. In winter it frequents houses for the sake of plunder, and will devour flesh greedily, whether fresh or putrid. It is also a constant attendant where horse-flesh is kept for hounds, and in the farm-yard, being partial to oats, which it plucks out, and retiring to a neighbouring bush fixes the grain between its claws, and hammers it with the bill, to break the husk. In summer, it feeds chiefly on insects, in search of which it plucks off a number of young buds from the trees. The nest is always made in some hole, either of a tree or wall, composed of moss, and lined with feathers and hair. The eggs are white, and speckled with rust-colour at the larger end. The female is so tenacious of her nest, that she will often suffer herself to be taken rather than quit it, and will frequently return again after being taken out. It menaces every intruder in a singular manner, hissing like a snake, erecting all its feathers, and uttering a noise like the spitting of a cat, biting at the same time, severely, if handled. It has no song, but utters a shrill note quickly repeated. 885 Caeruleus.

Colemouse or *cole titmouse.*—Head black; back cinereous; hind head and breast white; bill and chin black; 886 Ater.

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Passeres. a broad black stripe beneath the eyes, from the bill to the neck; belly and vent reddish white; wing-coverts gray, tipt with white; quill and tail feathers brownish-ash, edged with gray; legs and claws lead coloured. Weight about two drams and a quarter; length four inches and a quarter. Has frequently been confounded with the *palustris;* but it is not so plentiful a species; keeps more to woods; seems to live entirely on insects, and has also a diffrent note.

887 *Palustris.* *Marsh titmouse.*—Head black; back cinereous; temples white. The markings are, however, very subject to vary; the length is about four inches and a half; and the weight two drams and a half. Inhabits Europe. With the blue species it partakes of flesh, and haunts the oat-ricks. It seems to be partial to low wet ground, where old willow trees abound, in the holes of which it frequently nestles.

888 *Caudatus.* *Long-tailed titmouse.*—Crown white; tail longer than the body; weighs only two drams, and measures five inches and a quarter in length. This very elegant and singular species is confined chiefly to the woods and thickets of Europe and Siberia, where it makes a curious oval nest of lichens, firmly woven together with wool; and having only a small hole on the side, placed in the fork of some bush or branch of a tree. The female lays from nine to seventeen eggs, which are white, and sparingly marked with small rust-coloured spots towards the larger end.

889 *Capensis.* *Cape titmouse.*—Gray ash; quill feathers black, edged with white; tail black above; bill and legs black. Inhabits the Cape of Good Hope. Constructs a luxurious nest of the down of a species of asclepias; near the upper end projects a small tube, about an inch in length, with an orifice about three-fourths of an inch in diameter. Immediately under the tube is a small hole in the side, that has no communication with the interior of the nest. In this hole the male sits at night; and thus both male and female are screened from the weather.

890 *Biarmicus.* *Bearded titmouse.*—Rufous; crown hoary; tail longer than the body; head bearded; vent black; bill pale orange; irides yellow; legs black; tail wedged; whiskers composed of long black feathers; three outer tail feathers black at the base, and whitish at the tips; middle of the breast flesh coloured; sides and thighs pale orange; six inches and a quarter long. Inhabits marshy situations in Europe. Though it breeds with us, and continues the whole year, its history is little known; and authors differ not only with respect to the shape and composition of the nest, but even with respect to the place of nidification.

891 *Pendulinus.* *Penduline titmouse,* or *remiz.*—Head ferruginous; ocular band black; quill and tail feathers brown, and edged on each side with ferruginous; four inches and a half long. Inhabits Europe and Siberia, frequenting watery places for the sake of aquatic insects, on which it feeds. The most curious fact in the history of these birds is the exquisite art displayed in the construction of their nest. They employ the light down found on the buds of the willow, the poplar, and the asper, on thistles, dandelion, &c. With their bill they entwine this filamentous substance, and form a thick close web, almost like cloth. This they fortify externally with fibres and small roots, which penetrate into the texture, and, in some measure, compose the basis of the nest. They line the inside with the same down, but not woven, that their young may lie soft; they shut it above to confine the warmth, and they suspend it with hemp, nettles, &c. from the cleft of a small pliant branch over some stream, that it may rock more gently, assisted by the spring of the branch. In this situation the brood are well supplied with insects, which constitute their chief food, and are at the same time protected from their enemies. The nest sometimes resembles a bag, and sometimes a short purse. The aperture is made in the side, and is almost always turned towards the water. It is nearly round, and only an inch and a half in diameter, or even less, and is often, though not always, surrounded by a brim. These nests are found in the fens of Bologna, Tuscany, Lithuania, Poland, and Germany. The peasants regard them with superstitious veneration, one of them being usually suspended near the door of each cottage, as a charm against lightning. Passeres.

Languedoc titmouse.—Rufous gray; crown hoary; wings and tail blackish, edged with rufous; primary quill feathers edged with white; four inches long. Inhabits France. Builds a strong pendulous nest on the forked branch of a tree. 892 *Narbonensis.*

Amorous titmouse.—Blackish blue; longitudinal spot on the middle of the wings, half yellow and rufous; five inches and a half long. Inhabits Northern Asia, and is remarkable for the mutual affection of the sexes. 893 *Amatorius.*

Gen. 90. HIRUNDO, *Swallow.* 894 Hirundo.

Bill small, weak, curved, subulated, depressed at the base; gape larger than the head; tongue short, broad, cleft; wings long; tail mostly forked. 895 Characters.

The birds of this genus are readily distinguished, not only by their structure, but by their twittering voice, and their manner of life. They fly with great rapidity, seldom walk, and perform all their functions either on the wing or sitting. By means of their wide mouth they easily catch insects (their principal food) in the air, or on the surface of the water. Naturalists have been much divided in their opinions respecting the migration of the swallow tribe. The Hon. Daines Barrington and others have supposed that they do not leave this country, but that they lie concealed and torpid, during winter, under water, in crevices of rocks, holes in sand banks, &c. In confirmation of this opinion they quote instances which appear to be sufficiently well authenticated. But a migration of the greater part of the birds is not to be contradicted, by what seems to be rather the effect of chance than design. Those that have been hatched late, and have not acquired sufficient strength to accompany their companions in their journey, may alone have supplied the above-mentioned instances. Were all to remain, we should undoubtedly be furnished with more numerous and more generally known examples than have hitherto been recorded. The ingenious Mr John Hunter, on dissecting several swallows, observed in them nothing different from other birds in the organs of respiration, and hence inferred, perhaps too hastily, that none of them can remain, for any length of time, under water. That the migration of swallows does, however, really take place, appears to have been fully proved by a variety of well-attested facts, most of which have been observed by navigators, who were eye-witnesses of the flights of these birds, and whose ships have sometimes afforded

Passeres. forded to them resting places in the course of their toilsome progress.

A. *Three toes before, and one behind.*

896 *Rustica.* *Chimney or common swallow.*—Front and chin chesnut; tail feathers, except the two middle ones, with a white spot; bill black; body blackish blue above, whitish beneath; tail very much forked; legs short and blackish; weight between five and six drams; length six inches and a half. Inhabits all the quarters of the world; visits us early in April, if the weather be mild, and retires about the end of September or beginning of October. It is supposed to winter in Senegal, and other warm countries. It has got the name of *Chimney swallow*, from the circumstance of breeding in chimneys. It also nestles on the beams or rafters of out-houses, and sometimes on rocks. The nest is made of mud, plastered together, and lined with feathers, and is open at top. The eggs are four or five, white, and speckled with rusty red. Its velocity of wing and quickness of sight are truly astonishing, and enable it to pursue its prey with precision and effect. When a fly is taken, a smart snap from the bill is to be heard, not unlike the noise of the shutting of a watch case; but the motion of the mandibles is too quick for the eye. Wonderful is the address with which this bird ascends and descends through the passages of a chimney. When hovering over the roof of the funnel, the vibrations of its wings acting on the confined air, occasion a rumbling like distant thunder. It is not improbable that the female submits to the inconvenience of having her nest low down in the shaft, in order to secure her offspring from the birds of prey, particularly from owls, which are frequently found to fall down chimneys, probably in their attempts to get at the nestlings. The progressive method by which the young are introduced to their proper habits, deserves to be noted. They first, though not without difficulty, emerge from the shaft, and, for a day or two, are fed on the chimney top, thence they are conducted to the dead leafless bough of some neighbouring tree, where, sitting in a row, they are attended by the parents with great assiduity. In a day or two after this they are strong enough to fly, but continue still unable to take their own food; they therefore play about near the place where the females are watching for flies; and, when a mouthful is collected, on a certain signal, the dam and the nestling advance, rising towards each other, and meeting at an angle, the young all the while, uttering a short quick note of gratitude and complacency. As soon as the mother has disengaged herself from the first brood, she immediately commences her operations for a second, which is produced about the middle or latter end of August.

897 *Esculenta.* *Esculent swallow.*—Blackish, whitish beneath; all the tail feathers with a white spot; bill black; tail tipt with white; legs brown. Two inches and a quarter in length; in size rather less than the wren. Inhabits China and the islands of the Indian ocean. Many of our readers must have heard of the curious eatable nests of this species. The following is the account given of them by Sir George Staunton. "In the Cass, a small island near Sumatra, were found two caverns, running horizontally into the side of the rock; and in these were a number of those birds nests so much prized by the Chinese epicures. They seem to be composed of fine filaments, cemented together by a transparent viscous matter, not unlike what is left by the foam of the sea upon stones alternately covered by the tide, or those gelatinous animal substances found floating on every coast. The nests adhere to each other, and to the sides of the caverns; mostly in rows, without any break or interruption. The birds that build these nests are small gray swallows, with bellies of a dirty white. They were flying about in considerable numbers; but were so small, and their flight was so quick, that they escaped the shot fired at them. The same sorts of nests are said to be also found in deep caverns at the foot of the highest mountains in the middle of Java, at a distance from the sea: from which source it is thought that the birds derive no materials, either for their food, or the construction of their nests; as it does not appear probable they should fly in search of either, over the intermediate mountains, which are very high, or against the boisterous winds prevailing thereabout. They feed on insects, which they find hovering over stagnated pools between the mountains, and for the catching of which their wide-opening beaks are particularly adapted. They prepare their nests from the best remnants of their food. Their greatest enemy is the kite, who often intercepts them in their passage to and from the caverns, which are generally surrounded with rocks of gray limestone, or white marble. The nests are placed in horizontal rows, at different depths, from 50 to 500 feet. The colour and value of the nests depend on the quantity and quality of the insects caught, and perhaps also on the situation where they are built. Their value is chiefly ascertained by the uniform fineness and delicacy of their texture; those that are white and transparent being most esteemed, and fetching often in China their weight in silver.—These nests are a considerable object of traffic among the Javanese, many of whom are employed in it from their infancy. The birds, after having spent nearly two months in preparing their nests, lay each two eggs, which are hatched in about 15 days. When the young birds become fledged, it is thought the proper time to seize upon their nests, which is done regularly three times a-year, and is effected by means of ladders of bamboo and reeds, by which the people descend into the caverns: but when these are very deep, rope-ladders are preferred. This operation is attended with much danger, and several perish in the attempt. The inhabitants of the mountains, generally employed in this business, begin always by sacrificing a buffalo; which custom is observed by the Javanese, on the eve of every extraordinary enterprise. They also pronounce some prayers, anoint themselves with sweet-scented oil, and smoke the entrance of the cavern with gum-benjamin. Near some of the caverns a tutelar goddess is worshipped, whose priest burns incense, and lays his protecting hands on every person preparing to descend. A flambeau is carefully prepared at the same time, with a gum which exudes from a tree growing in the vicinity, and which is not easily extinguished by fixed air or subterraneous vapours."—The nest of this species generally weighs about half a ounce; and is in shape something like a half lemon. The consistency of the several layers of component matter approaches to that of isinglass, or of fine gum-dragon. Such of these nests as are perfectly free from dirt, are dissolved in broth to thicken it, and are said to give it an exquisite flavour; or they are soaked in

Passeres. in water to soften them, then pulled in pieces, and, after being mixed with ginseng, are put into the body of a fowl. The whole is then stewed in a pot, with a sufficient quantity of water, and left on the coals all night. On the following morning it is ready to be eaten.

898 Urbica. *Martin, martlet, martinet*, or *house martin*.—Bluish-black above, white beneath; tail feathers without spots; bill black; mouth yellow; rump white; legs covered with a short white down. There is a variety that has the quill and tail feathers tipt with white. About five inches and a half, and rather inferior in size to the chimney swallow. Inhabits Europe, Asia, and North America. Visits Britain in spring, rather later than the common swallow, making its first appearance in low, warm situations, and if the weather is fine, beginning to build early in May. It builds a close nest made of straw and clay, and lined with feathers, with a hole at top for admission, in windows, under the eaves of houses, the projecting ornaments of steeples and churches, &c. and sometimes against rocks or cliffs, contiguous to the sea. The eggs are four or five, and pure white. The manners and habits of this well-known species nearly resemble those of the common swallow.

899 Riparia. *Sand martin, bank martin, or shore bird*.—Cinereous; chin and belly white; bill blackish; throat encircled with a mouse-coloured ring; legs black, and downy behind. Four inches and three quarters long. Inhabits Europe and America, in which last country it is called *ground swallow*. In this country it is not so plentiful as the preceding, with which it associates, and which in its manners it much resembles, except that it nestles in the banks of rivers or sand pits, and makes a nest of straw and dried fibres, lined with feathers.

900 Purpurea. *Purple swallow*.—Entirely violet; tail forked; bill black; legs blackish. Female brown. Seven inches and three quarters long. Inhabits Carolina and Virginia, during summer. Is much valued by the inhabitants for its use in alarming poultry on the approach of birds of prey, which it does not only by shrieking, but attacking them with the greatest fury.

901 Subis. Plate CCCCII. fig. 3. *Canada swallow*.—Bluish black; beneath and mouth whitish-ash; belly white, clouded with brown; quill and tail feathers blackish, edged with brown; legs and claws dusky. Eight or nine inches long. Native of Hudson's bay.

902 Ambrosiaca. *Ambergrise swallow*.—Grayish-brown; bill blackish; legs brown. Five inches and a half long. Inhabits Senegal. Smells strongly of ambergrise.

903 Erythrocephala. *Red-headed swallow*.—Dusky-black, the feathers edged with white; under part of the body white; head red. Size of the least humming bird. Inhabits India.

904 Nigra. *Black swallow*.—Entirely black. Six inches long. Inhabits the interior parts of South America, and builds in a deep hole in the ground, with a long entrance.

905 Apus. *Swift, black martin*, &c.—Blackish; chin white. Weight nearly an ounce; length about eight inches. Inhabits almost every where. The swift makes its appearance with us later than any of the other species, being seldom seen till May. It frequents steeples, towers, and other lofty buildings, in the holes of which, or under the tiles of houses and barns, it makes a nest of dried grass, lined with feathers, which it collects on wing, sweeping them off the ground in a dexterous manner. Like the swallow, it sips the water, and at the same time, picks up flies as it skims over the surface. The female lays only two white eggs of an oblong shape, larger than that of the swallow; and while she is sitting, the male is continually flying to and from the spot, making a screeching noise, which is its only note. At night, both sit on the nest, or at least roost in the same hole. In very warm weather, these birds soar to a great height; but in cold or moist weather, fly low in search of flies and other winged insects, which at that time cannot ascend. This species disappears about the middle of August, remaining here no longer than is necessary for its breeding. It is remarkable that it disappears soonest in the best and warmest weather; and that in the very inclement season of 1782, numbers of them were seen in the neighbourhood of Edinburgh, so late as the 25th of August, flying about with their usual spirit and vivacity, when the thermometer stood at 36°. It is neither cold, therefore, nor the want of food, which disposes them to quit us so early. They have the process of moulting to undergo, which cannot be performed in a state of torpor. Their place of retirement, however, has not been ascertained.

White-collared swift.—Blackish-violet; head black; collar bifid; ocular band and thighs white. Five inches and one quarter long. Inhabits Cayenne. Builds a long conical nest, with a division in the middle. 906 Cayennensis.

Gen. 91. Caprimulgus, *Goatsucker*. 907 Caprimulgus.

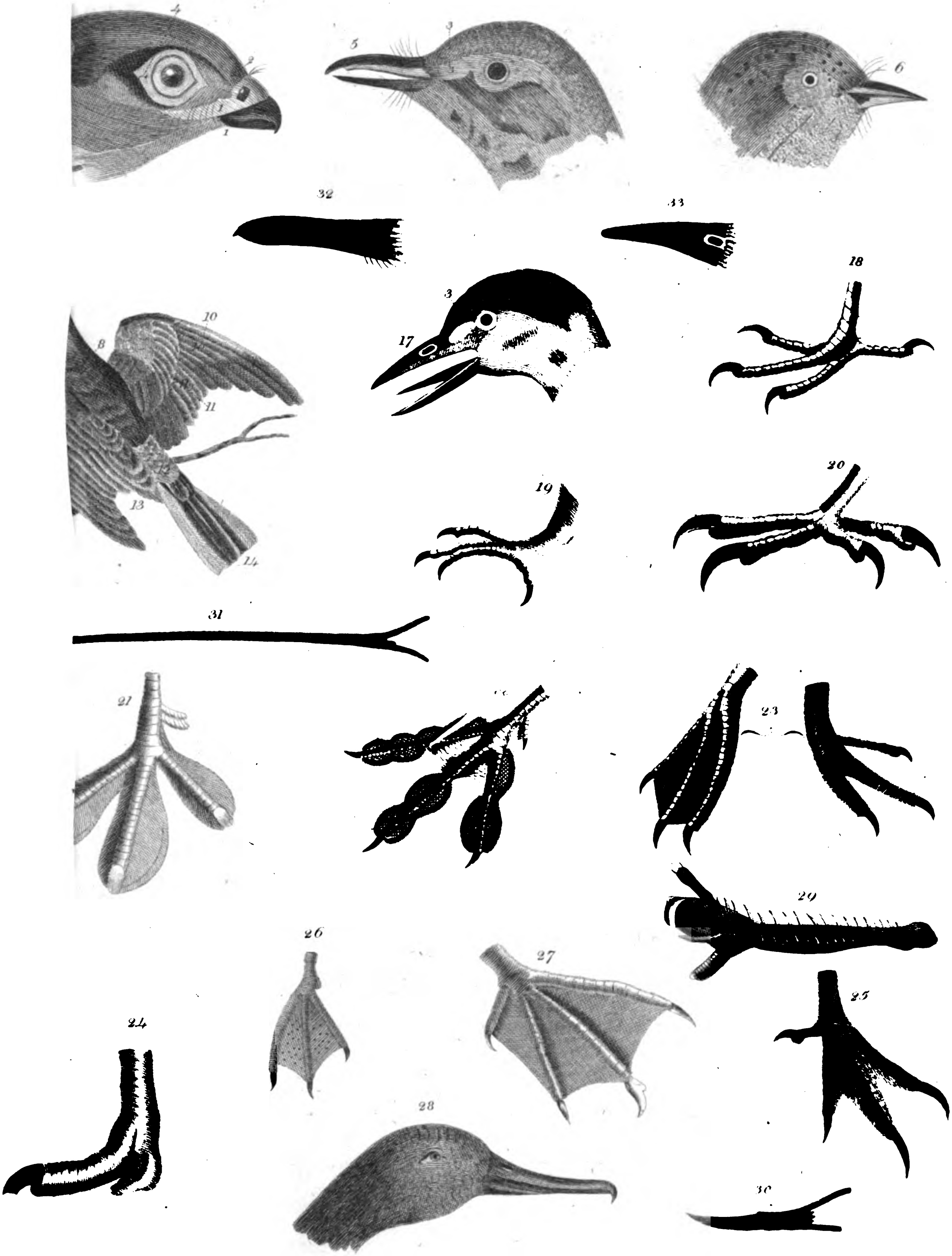
908 Characters. Bill slightly curved, very small, subulated and depressed at the base; mouth extremely wide, and furnished at the sides with a series of bristles; ears very large; tongue pointed and entire; tail unforked, with 10 feathers; legs short, middle claw with a broad serrated edge.

The birds of this family seldom appear in the day time, except they are disturbed, or in dark cloudy weather, but wander about in the evening, in search of insects. They lay two eggs on the naked ground. The lateral toes are connected to the middle one by a small membrane.

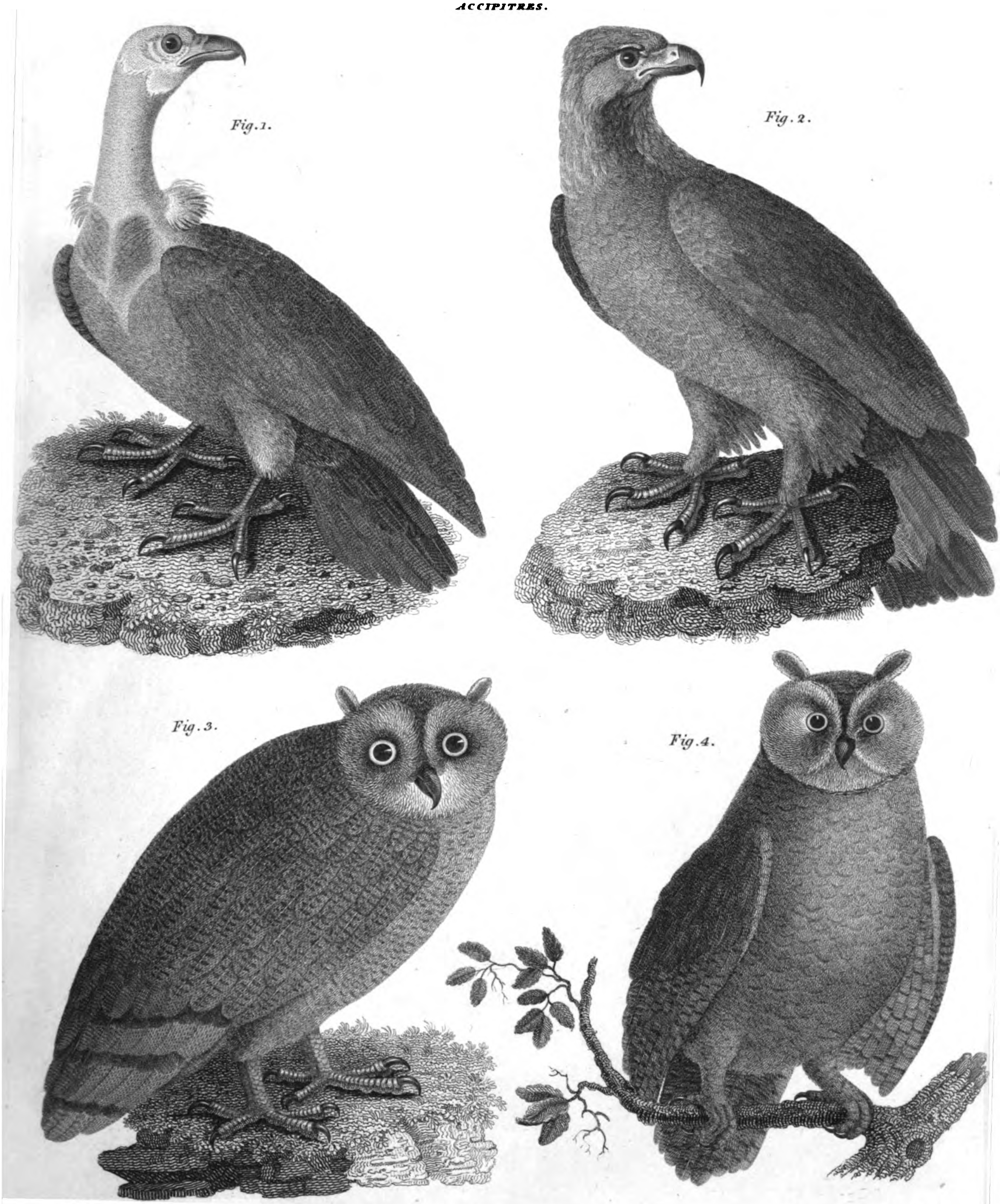
European or *nocturnal goatsucker*; provincially *night or dorrhawk, churn* or *goatowl, wheelbird, nightjarr*, &c.—Black, varied with cinereous, brown, ferruginous and white; beneath reddish-white, with brown bands; irides hazel; legs short, scaly, and feathered below the knees. The male is distinguished from the female by a large oval white spot near the end of the three first quill feathers, and another on the outmost tail feathers. Inhabits Europe, Asia, and America. With us this bird is only a summer visitant, appearing about the middle of May, and departing again the latter end of September, or beginning of October. It makes no nest, but lays two eggs on the bare ground, among fern, heath, or long grass, sometimes in woods or furze, but at all times contiguous to woods, in which it chiefly conceals itself by day. The eggs are larger than those of a blackbird, oblong oval, whitish, and elegantly marbled with light brown and ash-colour. It generally sits on the ground, but if molested, frequently perches on the limb of a tree, most commonly lengthwise, and not across, as is common with most birds. In the dusk of the evening, it begins its flight in pursuit of the larger insects, particularly *scarabæus melolontha*, and *solstitialis*, which rise from their earthy abode about that time. It is also fond of the large-bodied moths, and indeed allows few winged 909 Europæus.

ORNITHOLOGY. *PLATE CCCXCII.*

Explanation of Terms.



ACCIPITRES.



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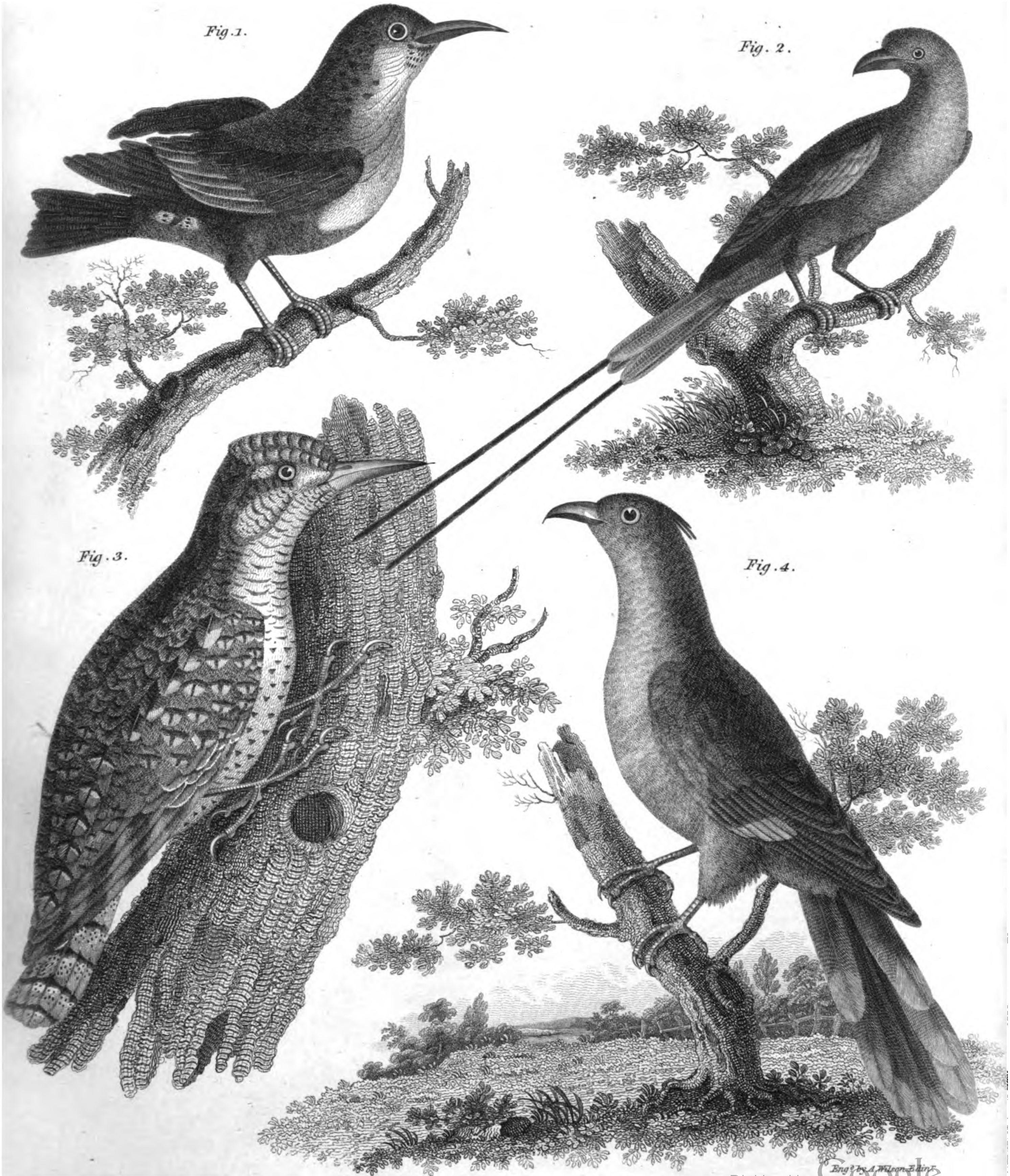
PICÆ.



Published by A. Constable & Co. Edinburgh 1817.

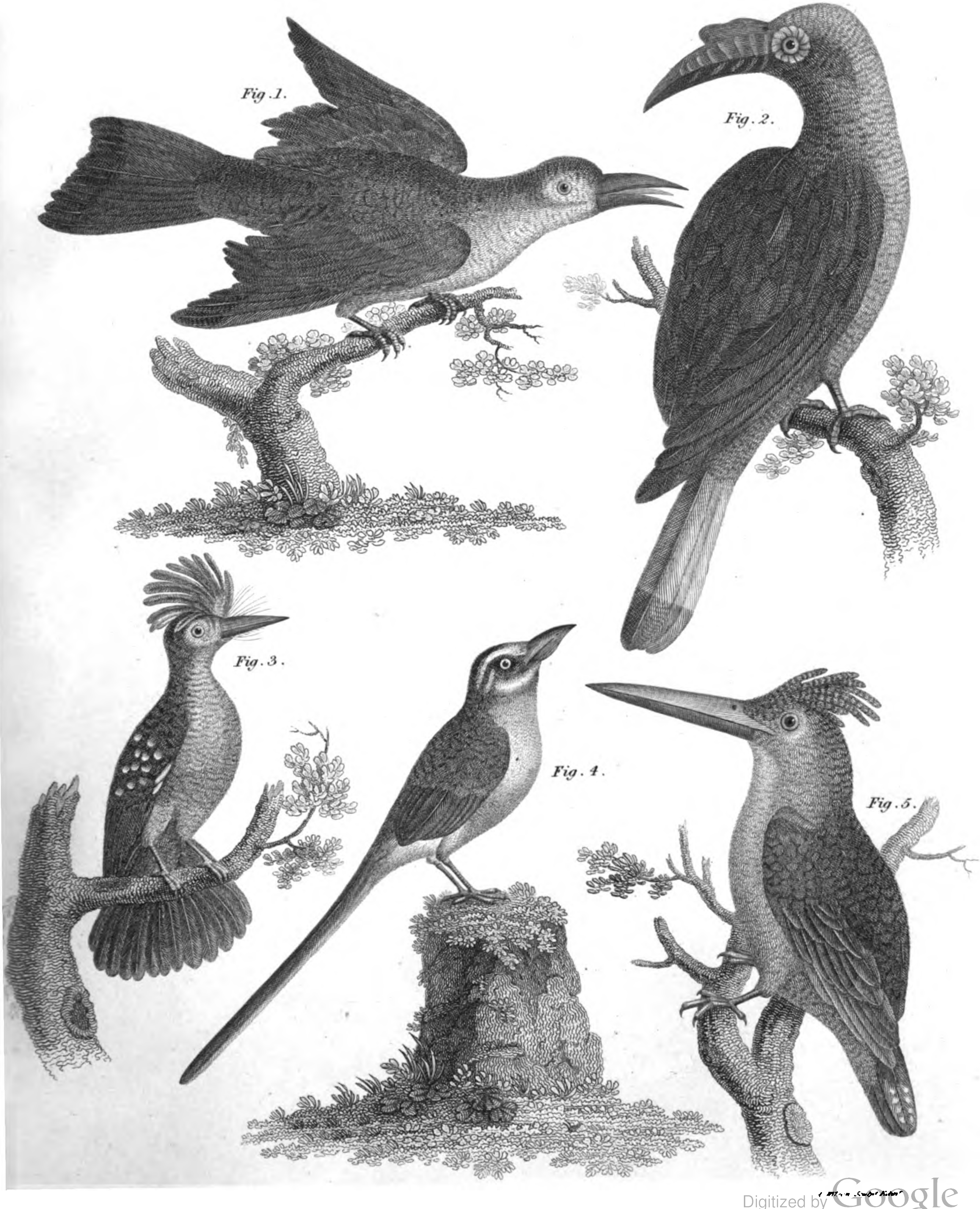

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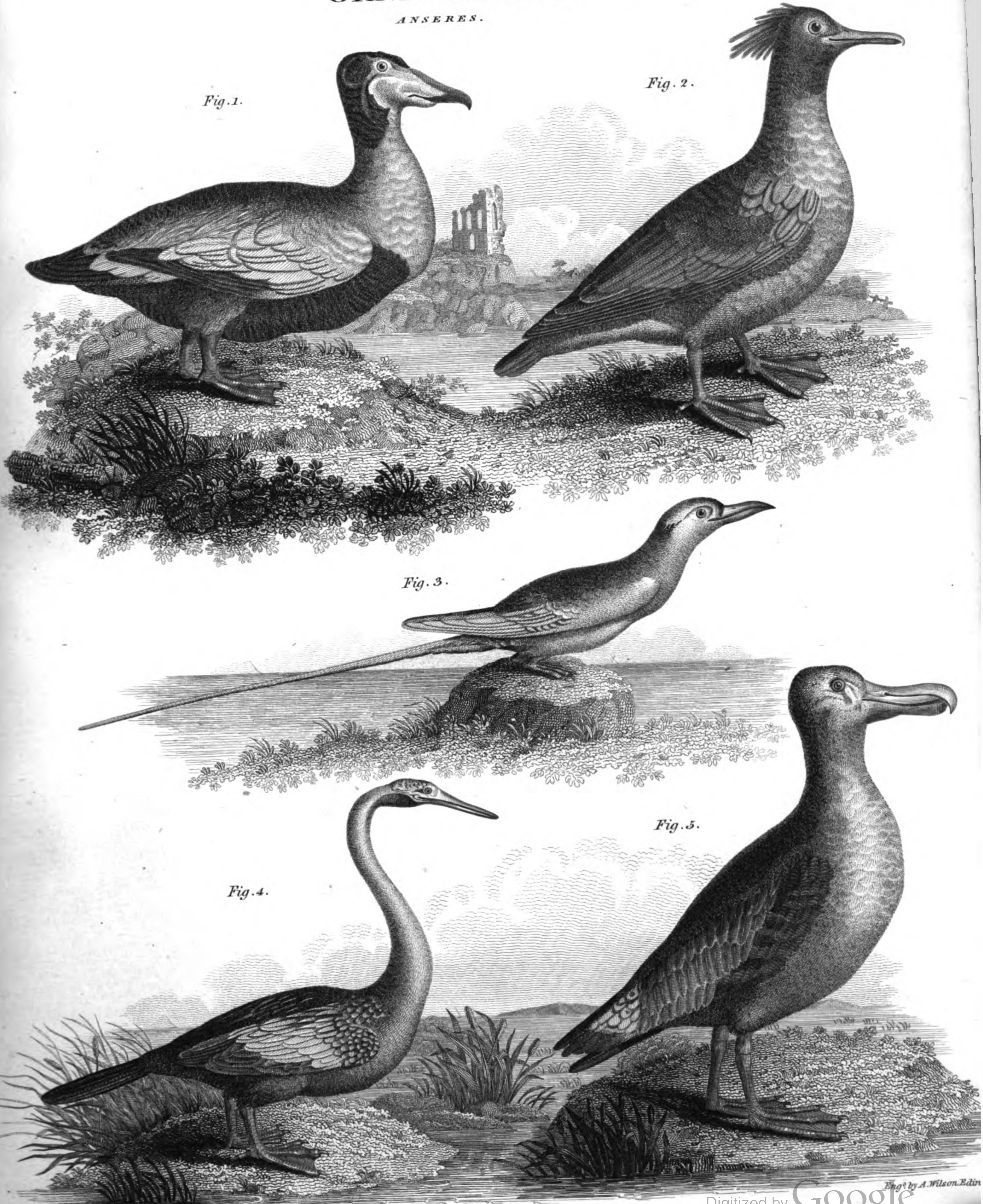
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.

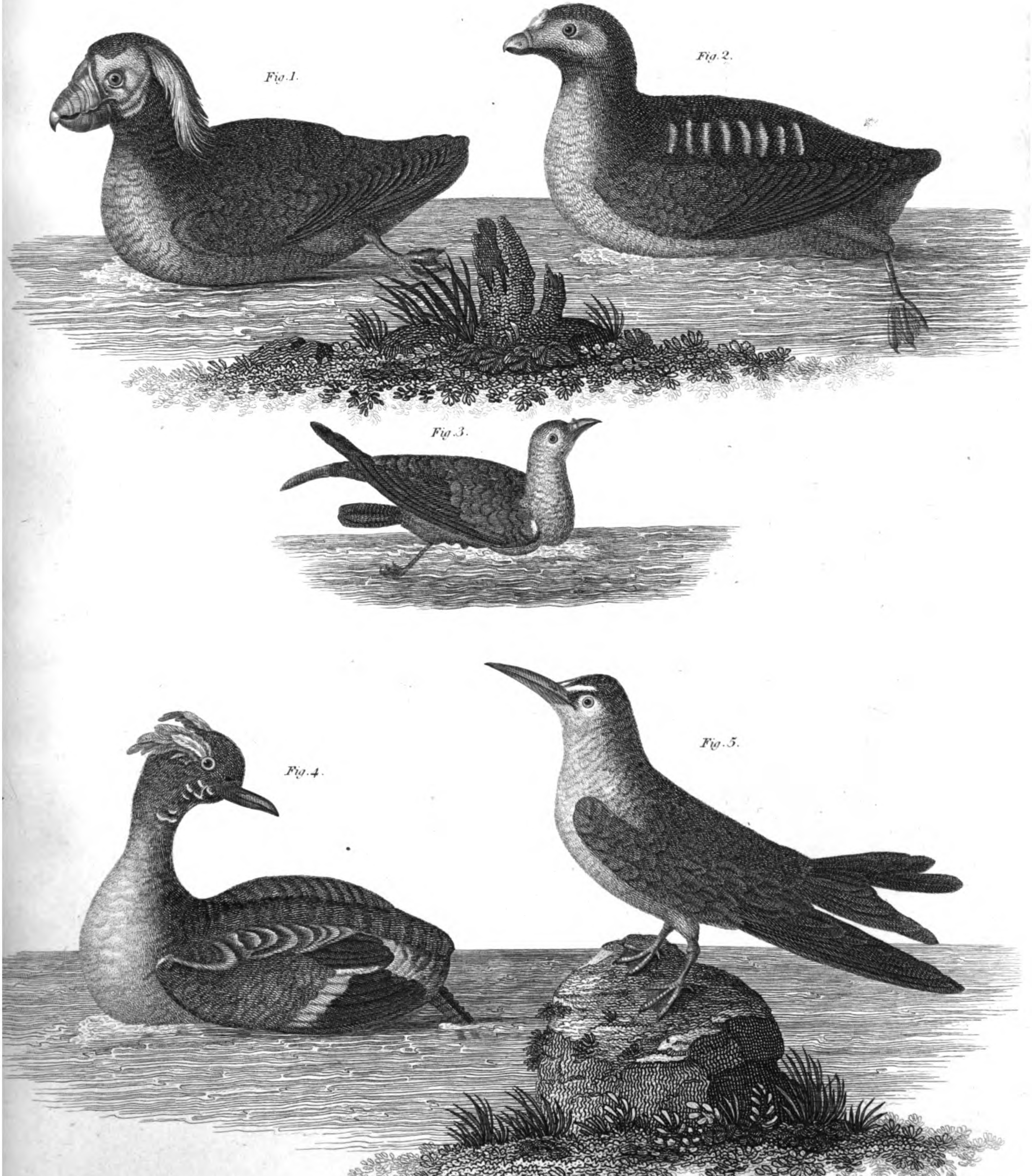
ANSERES.



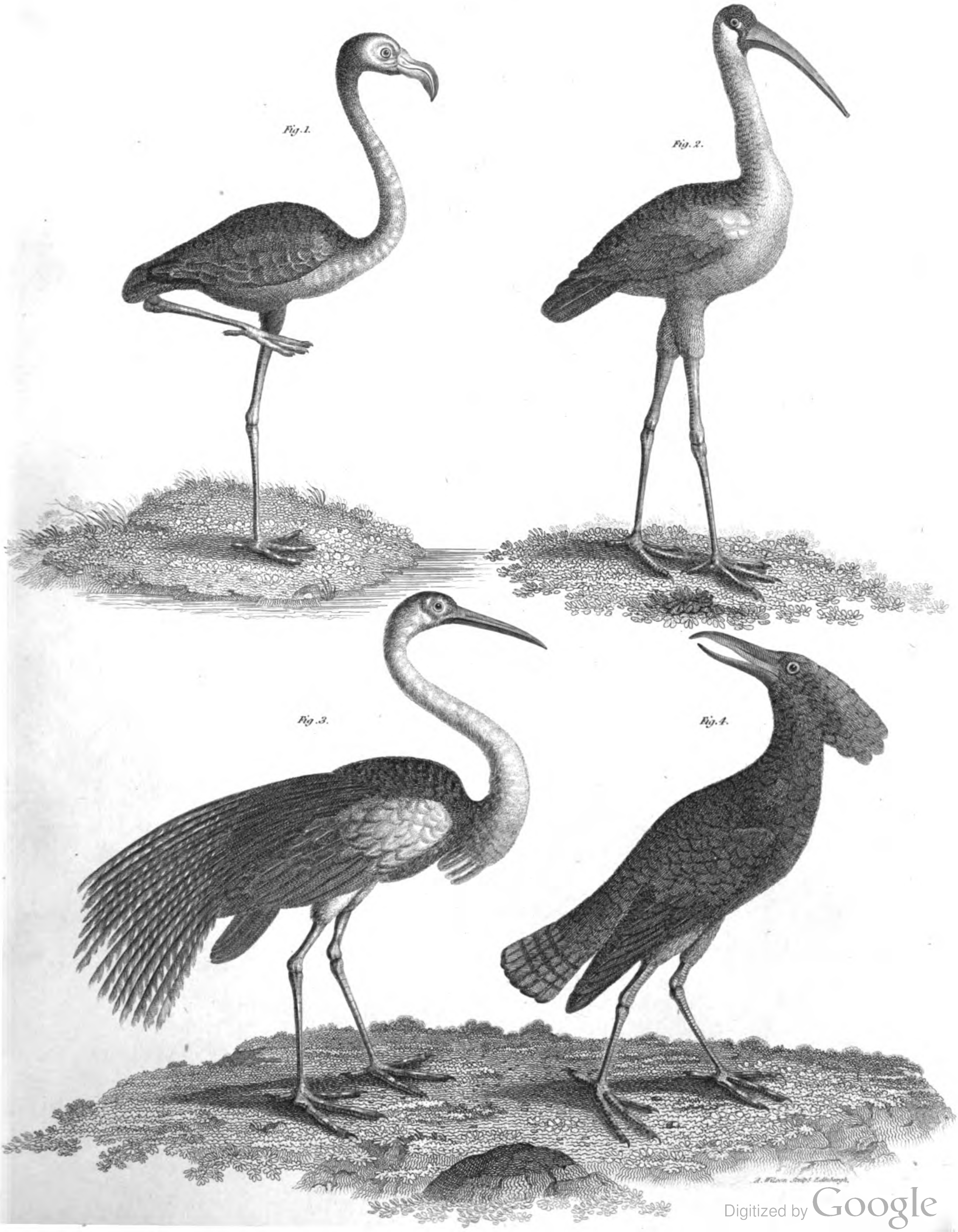
Engd. by A. Wilson Edin.

Published by A. Constable & Co. Edinburgh 1817.

ANSERES.

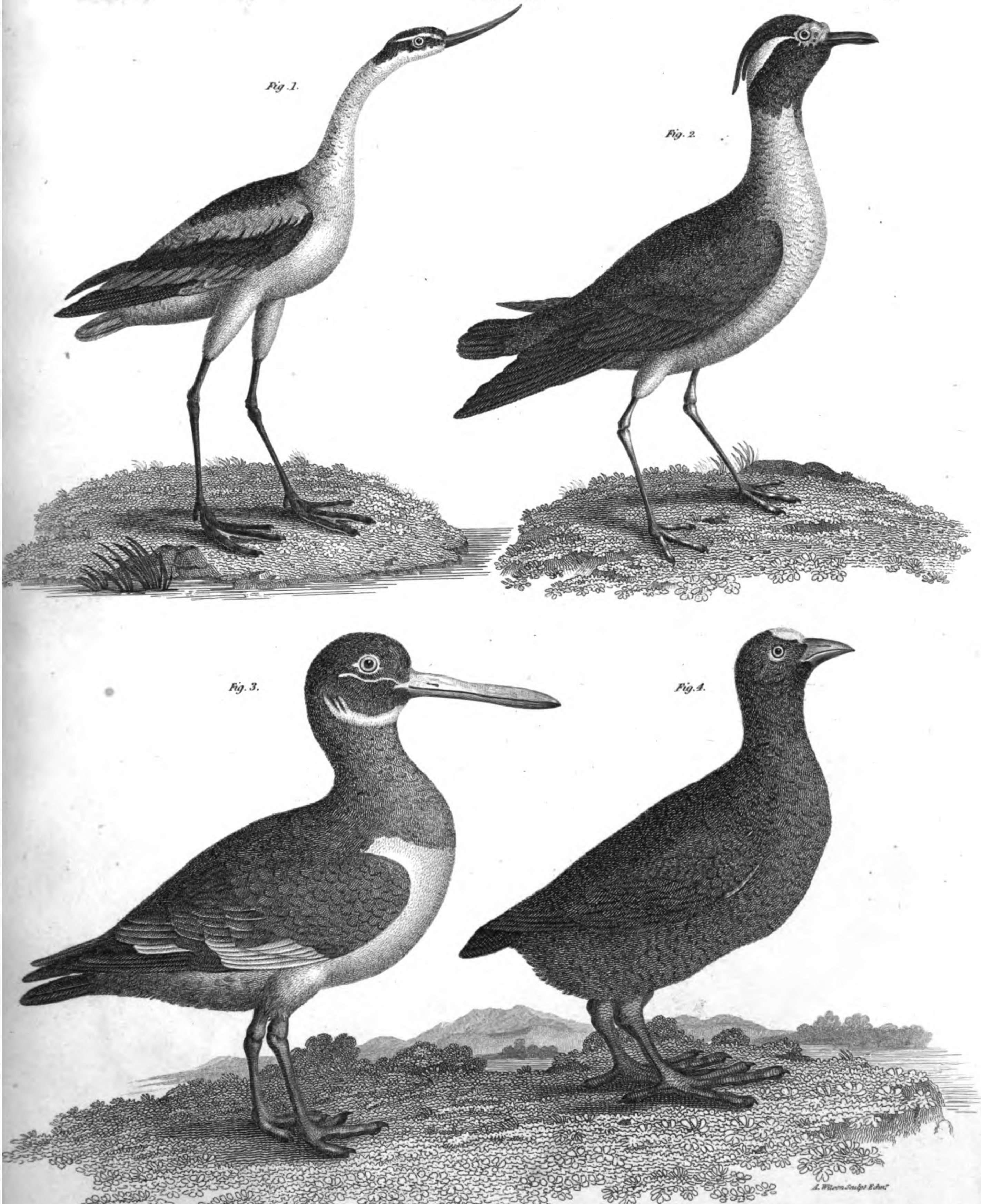


A. Wilson Sculp[t]

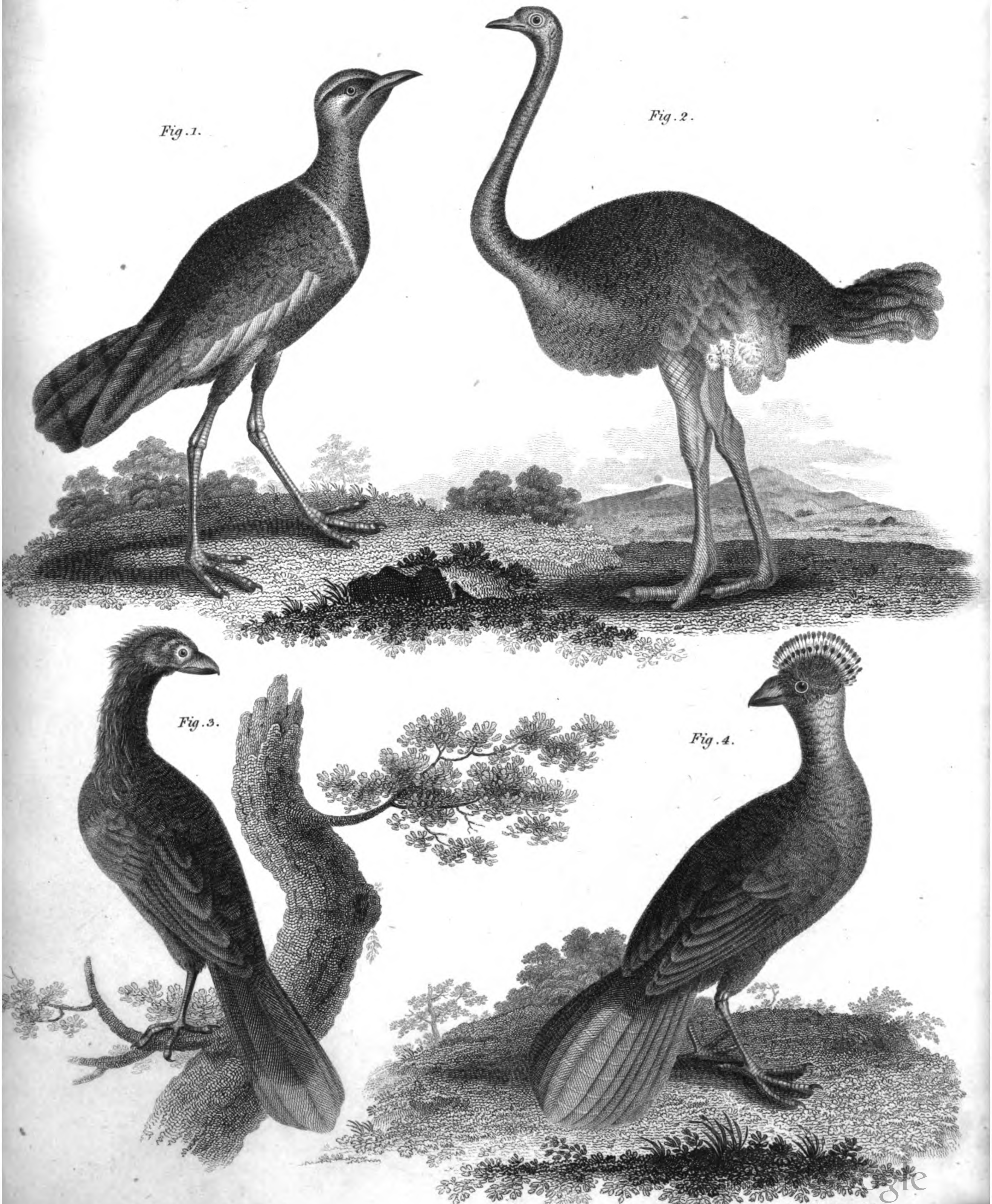


A. Wilson Sculp. Edinburgh.

GRALLÆ



GALLINÆ.



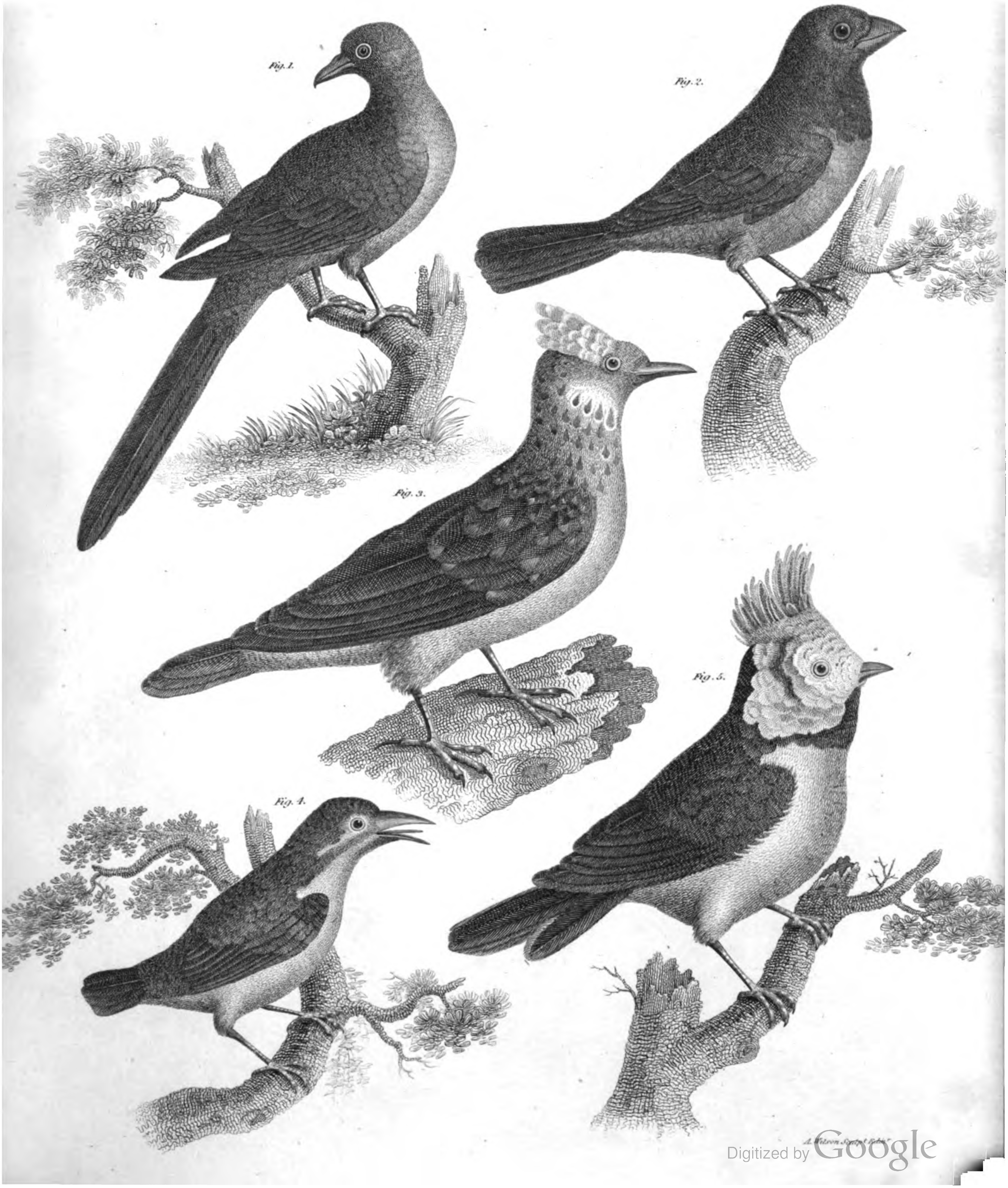


Fig. 1.
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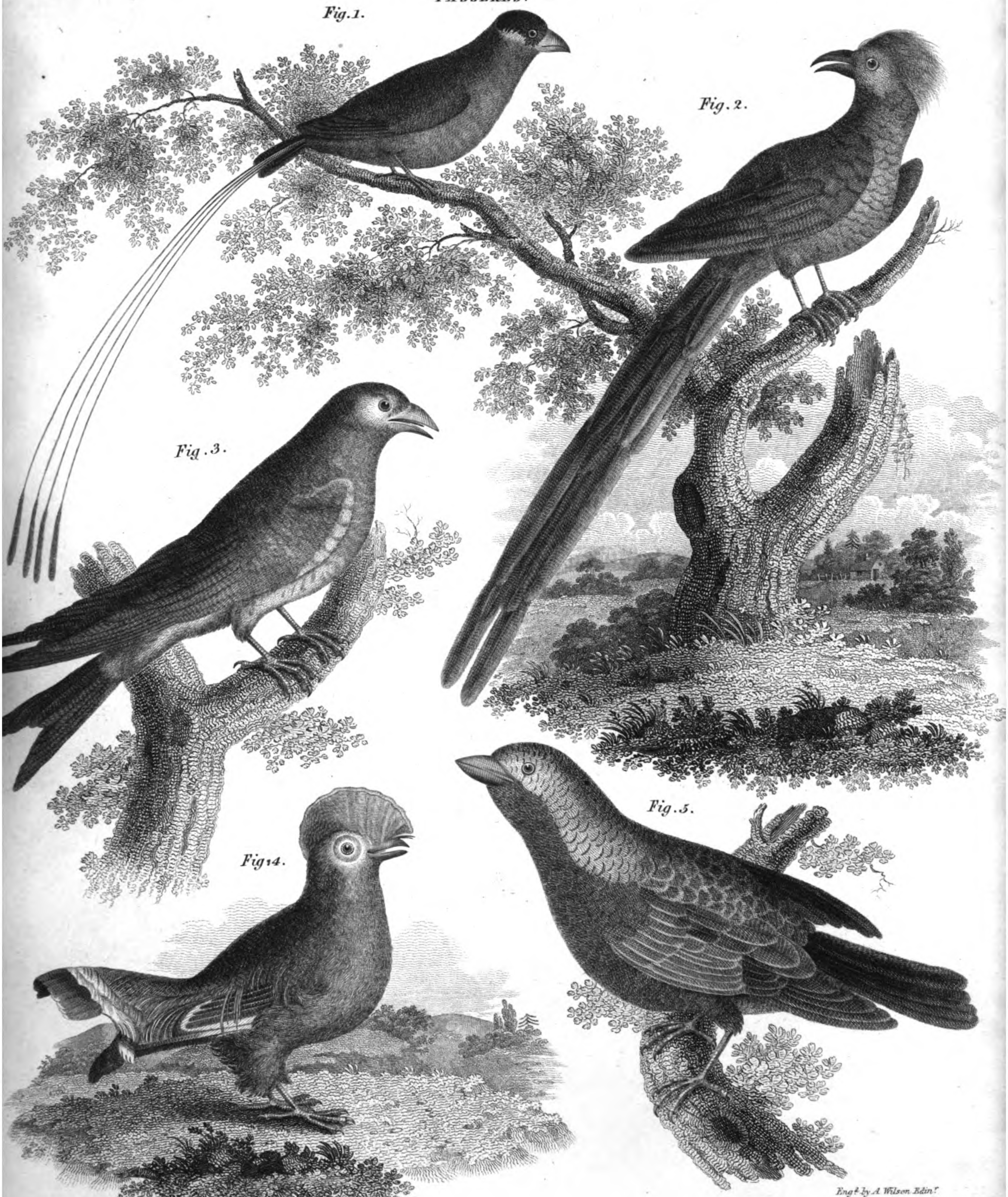
Fig. 5.

PASSERES.



Engd by A. Wilson Edinr

Passeres. winged insects to escape its wide extended gape. It makes a singular noise, like the sound of a large spinning wheel, and which it is observed to utter perched with the head lowermost; besides which, it utters a sharp squeak, as it flies. It has its name from the ancient, but erroneous belief, that it sucked the teats of goats.

910 Grandis. *Great goatsucker.*—Blackish, with small brown spots and streaks; area of the eyes yellowish; legs white; middle claw not serrated. Nearly two feet long. Inhabits Cayenne. The gape of its mouth can readily admit a man's fist.

911 Novæ Hollandiæ. *Crested goatsucker.*—Waved with brown, black, and whitish; whitish beneath; neck and breast with dusky bands; crest on the front erect, and setaceous. Nine inches and a half long. Inhabits New Holland. No account has hitherto been procured of its manners, except that it appears about our settlement at Port Jackson in March.

912 Longipennis. *Leone goatsucker.*—Variegated gray; wings spotted with rufous and black; a very long naked-shafted feather on each shoulder. "This singular species," says Dr Latham, "is about the size of the *European* one, and not far different from it in the general markings: the length from the bill to the end of the tail is eight inches and a quarter; but the remarkable circumstance belonging to it, is the having a single feather springing out of the middle part of the coverts of each wing, full 29 inches in length: this continues as a plain unwebbed shaft for 14 inches and three quarters, having a few solitary hairs, on the inside only; from thence it expands into a broad web for the remaining five inches and a quarter of its length. This part is mottled, not unlike the darker part of the rest of the plumage, and crossed with five dusky bars; the web or blade has almost the whole of its breadth on the inner side, being there more than one inch broad, but very narrow on the outer part of the shaft; the legs are small. Inhabits Sierra Leona in Africa; several of them have been brought into England," &c.—The same bird is described by Dr Shaw in his *Naturalists Miscellany*.

913 Menura. We have purposely reserved for an Appendix, the following description of *menura superba*, a bird of New South Wales, by Major-general Thomas Davies, F. R. and L. S.

"Menura.

Char. gen. *Rostrum* validiusculum, convexo-conicum.
Nares ovatæ in medio rostri.
Rectrices elongatæ, pinnulis decompositis; intermediæ duæ longiores angustæ, exteriores ad apicem patulæ, revolutæ.
Pedes validi ambulatorii.

Menura Superba.

"The total length of this singular bird, from the point of the bill to the end of the broad tail feathers, is 43 inches; 25 of which are in the tail alone. The bill rather exceeds an inch in length, is strong, formed much like that of a peacock, and black, with the nostrils, which are long open slits, rather large, placed near the middle of its length; the head, which is somewhat crested at the hind part, neck, shoulders, back, upper tail coverts, and upper surface of the tail-feathers, of a dark brownish-black; throat rufous, reaching some way down the middle of the neck; breast, belly, and vent gray; the feathers of the latter are long, very soft, and of a silky texture; thighs nearly of the same colour, rather long, and feathered down to the knee; scapulars of a brownish tinge; upper tail coverts and prime quill feathers, which are somewhat curved at the ends, brown black; edges of the quills gray; the legs long and very strong, covered with large scales, especially in front; the feet, which are likewise large, and the nails, are black; the last somewhat crooked, convex above and flat beneath; the hind nail near three quarters of an inch long.

Appendix.

"The tail consists in the whole of 16 feathers; all of which, except the two upper or middle ones, and the two exterior on each side, have long slender shafts furnished on each side with delicate long filaments, four inches or more in length, placed pretty close towards the rump, but more distant from each other as they approach the extremity, and resemble much those of the greater Paradise bird. The two middle or upper ones are longer than the rest, slender, narrow at the base, growing wider as they approach the ends, which are pointed; webbed on the inner edge all the way, and furnished with some distant hair like threads near the end on the outer side, of a pale gray colour beneath, and brown black above, as is the rest of the tail. The two exterior feathers on each side are of an extraordinary construction, rather more than an inch wide at the base, and growing wider as they proceed to the ends, where they are full two inches broad and curve outwardly; the curved part is black with a narrow white border; the quills of these feathers are double for two-thirds down from the rump. The general colour of the under sides of these two feathers is of a pearly hue, elegantly marked on the inner web with bright rufous coloured crescent-shaped spots, which from the extraordinary construction of the parts, appear wonderfully transparent, although at first sight seemingly the darkest; they are also elongated into slender filaments of an inch or more, especially towards the extremities.

"The figure of the male, which accompanies this description, was taken from a specimen sent from New South Wales as a present to Lady Mary Howe. I have also seen two other specimens in the possession of the right hon. Sir Joseph Banks, which I believe have since been deposited in the British Museum.

"Since I had the honour of communicating to the Linnæan Society the foregoing description of the *menura*, I have been favoured with both male and female of that extraordinary bird from my friend Governor King, by the Buffalo store ship; and I am thereby enabled to lay before the society a description of the different sexes. I find, indeed, that, with a little deviation, the same characters and colours will serve for both of them. The female, however, is somewhat smaller, being in length, from the crown of the head to the end of the tail, only 31 inches. The general plumage of the whole bird is of a dull blackish colour, a little rufous under the chin and throat, and of a brownish cast on the scapulars, as in the male. The plumage of the whole body, from the breast to the vent, and from the shoulders to the rump, is composed of long, slender, thread-like, silky feathers, resembling fringe, of a dull grayish-black; lighter on the breast, belly, and vent. The bill and legs, which are strong and furnished with large scales, as in the cock, are black. From the head to the rump 14 inches; the tail 18 inches, also of a dull brown black colour

Appendix. colour above and gray beneath; the two upper tail feathers are sharp-pointed at the ends; the rest are rounded and darker in colour, and shorter by degrees, as they approach the rump, so as to appear cuneated; the two outer feathers are shorter than the rest, but in form like those of the male, brown black above, of a pearly gray beneath; and the crescents, which are of a deeper rufous colour, are not so visible nor so large, but more transparent, if posible, than those of the cock. They are about an inch and a half broad, and not black or longer at the ends as in the other sex.

"From these birds being found in the hilly parts of the country, they are called by the inhabitants the *mountain pheasant.* With respect to their food or manners, I have not as yet obtained any particular account. In my specimens, there is a nakedness round the eyes, but whether this is from the feathers having fallen off I know not. I rather think otherwise, and that it may be brightly coloured as in many other birds."

For the most recent additions to Ornithology, see ZOOLOGY and VERTEBROSA, SUPPLEMENT.

EXPLANATION OF THE PLATES.

914 Explanation of plates.

Plate CCCXCIII. ACCIPITRES.

Fig. 1. *Vultur Percnopterus*, Aquiline Vulture.
2. *Falco Melanætos*, Black Eagle.
3. *Strix Zeylonensis*, Ceylon Owl.
4. —— *Virginiana*, Virginian Owl.

Plate CCCXCIV. PICÆ.

Fig. 1. *Certhia Armillata*, Braceletted Creeper.
2. *Coracias Caudata*, Long-tailed Roller.
3. *Picus Cardinalis*, Cardinal Woodpecker.
4. *Cuculus Melanoleucos*, Coromandel Crested Cuckoo.

Plate CCCXCV. PICÆ.

Fig. 1. *Merops Erythropterus*, Red-winged Bee-eater.
2. *Buceros Panayensis*, Panay Hornbill.
3. *Todus Cristatus*, Crested Tody.
4. *Momotus Brasiliensis*, Brasilian Motmot.
5. *Alcedo Cristata*, Crested King's-fisher.

Plate CCCXCVI. ANSERES.

Fig. 1. *Anas Mollissima*, Eider Duck.
2. *Mergus Serrator*, Red-breasted Merganser.
3. *Phaeton Æthereus*, Common Tropic Bird.
4. *Plotus Melanogaster*, Black-bellied Darter.
5. *Diomedea Exulans*, Wandering Albatross, or Man of War Bird.

Plate CCCXCVII. ANSERES.

Fig. 1. *Alca Cirrata*, Tufted Auk.
2. —— *Tetracula*, Dusky Auk.
3. *Procellaria Pelagica*, Stormy Petrel.
4. *Colymbus Auritus*, Eared Grebe.
5. *Sterna Minuta*, Lesser Tern.

Plate CCCXCVIII. GRALLÆ.

Fig. 1. *Phœnicopteros Ruber*, Red Flamingo.
2. *Tantalus Albus*, White Ibis.
3. *Ardea Egretta*, Great Egret.
4. *Scopus Umbretta*, Tufted Umbre.

Plate CCCXCIX. GRALLÆ.

Fig. 1. *Recurvirostra Americana*, American Avocet.
2. *Charadrius Pileatus*, Hooded Plover.
3. *Hæmatopus Ostralegus*, Sea-pie, or Pied Oyster-catcher.
4. *Fulica Atra*, Common Coot.

Plate CCCC. GALLINÆ.

Fig. 1. *Otis Afra*, White-eared Bustard.
2. *Struthio Camelus*, Black Ostrich.
3. *Phasianus Cristatus*, Crested Pheasant.
4. *Crax Alector*, Female Crested Curassow, Var. from Peru, *Lath. Synop.* 693.

Plate CCCCI. PASSERES.

Fig. 1. *Columba Marginata*, Marginated Turtle.
2. *Loxia Moluccensis*, Molucca Grosbeak.
3. *Alauda Malabarica*, Malabar Lark.
4. *Muscicapa Pygmæa*, Dwarf Fly-catcher.
5. *Parus Cristatus*, Crested Titmouse.

Plate CCCCII. PASSERES.

Fig. 1. *Emberiza Regia*, Shaft-tailed Bunting.
2. *Colius Panayensis*, Panayan Coly.
3. *Hirundo Subis*, Canada Swallow.
4. *Pipra Rupicola*, Rock Manakin.
5. *Tanagra Siberica*, Siberian Tanager.

INDEX.

ORNITHOMANCY, a species of divination performed by means of birds; being the same with augury. See DIVINATION and AUGURY.

ORNITHOPUS, a genus of plants belonging to the diadelphia class; and in the natural method ranking under the 32d order, *Papilionaceæ*. See BOTANY *Index*.

ORNITHORYNCHUS PARADOXUS, one of the most extraordinary animals of the mammalia class yet known, particularly for the singular conformation of its head, which is the perfect resemblance of the beak of a duck ingrafted on the head of a quadruped. See MAMMALIA *Index*.

ORNUS FRAXINUS, is that species of the ash tree, in the Linnæan system, which, according to Dr Cirillo of Naples, produces the manna. See MATERIA MEDICA *Index*.

OROBANCHE, a genus of plants belonging to the didynamia class; and in the natural method ranking under the 40th order, *Personatæ*. See BOTANY *Index*.

OROBIO, DON BALTHASAR, a celebrated Jew of Spain. He was carefully educated in Judaism by his parents, who were Jews, though they outwardly professed themselves Roman Catholics; abstaining from the practice of their religion in every thing, except only the observation of the fast of expiation, in the month Tisis or September. Orobio studied the scholastic philosophy usual in Spain, and became so skilled in it, that he was made professor of metaphysics in the university of Salamanca. Afterwards, however, applying himself to the study of physic, he practised that art at Seville with success, till, accused of Judaism, he was thrown into the inquisition, and suffered the most dreadful cruelties, in order to force a confession. He himself tells us, that he was put into a dark dungeon, so strait that he could scarce turn himself in it; and suffered so many hardships, that his brain began to be disturbed. He talked to himself often in this way: "Am I indeed that Don Balthasar Orobio, who walked freely about in Seville, who was entirely at ease, and had the blessings of a wife and children?" Sometimes, supposing that his past life was but a dream, and that the dungeon where he then lay was his true birth-place, and which to all appearance would also prove the place of his death. At other times, as he had a very metaphysical head, he first formed arguments of that kind, and then resolved them; performing thus the three different parts of opponent, respondent, and moderator, at the same time. In this whimsical way he amused himself from time to time, and constantly denied that he was a Jew. After having appeared twice or thrice before the inquisitors, he was used as follows: At the bottom of a subterraneous vault, lighted by two or three small torches, he appeared before two persons, one of whom was judge of the inquisition, and the other secretary; who, asking him whether he would confess the truth? protested, that in case of a criminal's denial, the holy office would not be deemed the cause of his death if he should expire under the torments, but that it must be imputed entirely to his own obstinacy. Then the executioner stript off his clothes, tied his feet and hands with a strong cord, and set him upon a little stool, while he passed the cord through some iron buckles which were fixed in the wall; then drawing away the stool, he remained hanging by the cord, which the executioner still drew harder and harder, to make him confess, till a surgeon assured the court of examinants, that he could not possibly bear more without expiring. These cords put him to exquisite tortures, by cutting into the flesh, and making the blood burst from under his nails. As there was certainly danger that the cords would tear off his flesh, to prevent the worst, care was taken to gird him with some bands about the breast, which however were drawn so very tight, that he would have run the risk of not being able to breathe, if he had not held his breath in while the executioner put the bands round him; by which device his lungs had room enough to perform their functions. In the severest extremity of his sufferings, he was told that this was but the beginning of his torments, and that he would better confess before they proceeded to extremities. Orobio added further, that the executioner, being on a small ladder, in order to frighten him, frequently let it fall against the shinbones of his legs; so that the staves being sharp, created exquisite pain. At last, after three years confinement, finding themselves baffled by his perseverance in denying his religion, they ordered his wounds to be cured, and discharged him. As soon as he had got liberty,

liberty, he resolved to quit the Spanish dominions; and, going to France, was made professor of physic at Thoulouse. The theses which he made as candidate for this place were upon putrefaction; and he maintained them with so much metaphysical subtlety, as embarrassed all his competitors. He continued in this city for some time, still outwardly professing popery; but at last, weary of dissembling, he repaired to Amsterdam, where he was circumcised, took the name of Isaac, and professed Judaism; still continuing, however, to practise physic, in which he was much esteemed. Upon the publication of Spinoza's book, he despised a system the falseness of which he quickly discovered; and when Bredenbourg's answer to it came to his hands, Orobio, being persuaded that the writer in refuting Spinoza, had also admitted some principles which tended to Atheism, took up his pen against them both, and published a piece to that purpose, intitled, *Certamen philosophicum adversus J. B. Principia*. But the dispute which he held with the celebrated Philip Limborch against the Christian religion made the greatest noise. Here he exerted the utmost force of his metaphysical genius, and carried himself with great temper. The three papers which he wrote on the occasion were afterwards printed by his antagonist, in an account which he published of the controversy, under the title of *Amica Collatio cum Judæo*. Orobio died in 1687.

OROBUS, Bitter Vetch, a genus of plants belonging to the diadelphia class; and in the natural method ranking under the 32d order, *Papilionaceæ*. See Botany *Index*.

ORODES, a prince of Parthia, who murdered his brother Mithridates, and ascended his throne. He defeated Crassus the Roman triumvir, and poured melted gold down the throat of his fallen enemy, to reproach him for his avarice and ambition. He followed the fortune of Cassius and Brutus at Philippi. It is said, that when Orodes became old and infirm, his 30 children disputed in his presence the right to the succession. Phraates, the eldest of them, obtained the crown from his father; and, to hasten him out of the world, he attempted to poison him. The poison had no effect; and Phraates, still determined on his father's death, strangled him with his own hands, about 36 years before the Christian era. Orodes had reigned about 50 years.

ORONOKO, or Orinoco, a large river of South America, which rises in Spanish Guiana, about 5° N. Lat. Its course has a spiral form, running first east, then south, then west, then north, and at last east again. It falls into the Atlantic ocean in N. Lat. 9° after a course of 1400 miles, during which it is joined by several large rivers, which flow eastward from the Andes.

ORONSA, a small fertile island of Scotland, one of the Hebrides, seven miles west of Jura. Here are the ruins of an abbey, with many sepulchral statues, and some curious ancient sculpture.

ORONTIUM, a genus of plants belonging to the hexandria class; and in the natural method ranking under the second order, *Piperitæ*. See Botany *Index*.

ORPHAN, a fatherless child or minor; or one that is deprived both of father and mother.

ORPHEUS, a celebrated poet and musician of antiquity. His reputation was established as early as the time of the Argonautic expedition, in which he was himself an adventurer; and is said by Apollonius Rhodius not only to have excited the Argonauts to row by the sound of his lyre, but to have vanquished and put to silence the Sirens by the superiority of his strains. Yet, notwithstanding the great celebrity he had so long enjoyed, there is a passage in Cicero, which says, that Aristotle, in the third book of his *Poetics*, which is now lost, *doubted if such a person as Orpheus ever existed*. But as the work of Cicero, in which this passage occurs, is in dialogue, it is not easy to discover what was his own opinion upon the subject, the words cited being put into the mouth of Caius Cotta. And Cicero, in other parts of his writings, mentions Orpheus as a person of whose existence he had no doubts. There are several ancient authors, among whom is Suidas, who enumerate five persons of the name of *Orpheus*, and relate some particulars of each. And it is very probable that it has fared with Orpheus as with Hercules, and that writers have attributed to *one* the actions of *many*. But, however that may have been, we shall not attempt to collect all the fables that poets and mythologists have invented concerning him; they are too well known to need insertion here. We shall, therefore, in speaking of him, make use only of such materials as the best ancient historians, and the most respectable writers among the moderns, have furnished towards his history.

Dr Cudworth, in his *Intellectual System* *, after examining and confuting the objections that have been made to the being of an Orpheus, and with his usual learning and abilities clearly establishing his existence, proceeds, in a very ample manner, to speak of the opinions and writings of our bard, whom he regards not only as the first musician and poet of antiquity, but as a great mythologist, from whom the Greeks derived the Thracian religious rites and mysteries.

* Book i. sect. 17.

"It is the opinion (says he) of some eminent philologers of latter times, that there never was any such person as Orpheus, except in Fairy land; and that his whole history was nothing but a mere romantic allegory, utterly devoid of truth and reality. But there is nothing alleged for this opinion from antiquity, except the one passage of Cicero concerning Aristotle; who seems to have meant no more than this, that there was no such poet as Orpheus anterior to Homer, or that the verses vulgarly called *Orphical*, were not written by Orpheus. However, if it should be granted that Aristotle had denied the existence of such a man, there seems to be no reason why his single testimony should preponderate against the universal consent of all antiquity; which agrees that Orpheus was the son of Oegar, by birth a Thracian, the father or chief founder of the mythological and allegorical theology amongst the Greeks, and of all their most sacred religious rites and mysteries; who is commonly supposed to have lived before the Trojan war, that is, in the time of the Israelitish judges, or at least to have been senior both to Hesiod and Homer; and to have died a violent death, most affirming that he was torn in pieces by women, because their husbands deserted them in order to follow him. For which reason, in the vision of Herus Pamphilius, in Plato, Orpheus's soul passing into another body, is said to have chosen that of a swan, a reputed musical animal, on account of the great hatred he had conceived for all women, from the death which they had inflicted on him. And the historic truth of Orpheus was not only acknowledged by Plato, but also by Isocrates, who lived before Aristotle,

stotle, in his oration in praise of Busiris; and confirmed by the grave historian Diodorus Siculus, who says, that Orpheus diligently applied himself to literature, and when he had learned τα μυθολογυμενα, or the mythological part of theology, he travelled into Egypt, where he soon became the greatest proficient among the Greeks in the mysteries of religion, theology, and poetry. Neither was his history of Orpheus contradicted by Origen, when so justly provoked by Celsus, who had preferred him to our Saviour: and, according to Suidas, Orpheus the Thracian was the first inventor of the religious mysteries of the Greeks, and that religion was thence called Θρησκεια, *Threskeia*, as if a Thracian invention. On account of the great antiquity of Orpheus, there have been numberless fables intermingled with his history; yet there appears no reason that we should disbelieve the existence of such a man."

Cudworth is also of opinion, that the poems ascribed to Orpheus were either written by him, or that they were very ancient, and contained his doctrines. He farther argues, that though Orpheus was a polytheist, and asserted a multiplicity of gods, he nevertheless acknowledged one supreme unmade deity, as the original of all things; and that the Pythagoreans and Platonists not only had Orpheus in great esteem, being commonly called by them the *Theologer*, but were also thought in great measure to have owed their theology and philosophy to him, deriving it from his principles and traditions.

The bishop of Gloucester* speaks no more doubtfully of the existence of Orpheus than of Homer and Hesiod, with whom he ranks him, not only as a poet, but also as a theologian, and founder of religion.

* Warburton.

The family of Orpheus is traced by Sir Isaac Newton for several generations · "Sesac passing over the Hellespont, conquers Thrace; kills Lycurgus king of that country; and gives his kingdom and one of his singing women to Oeagrus, the son of Tharops, and father of Orpheus; hence Orpheus is said to have had the muse Calliope for his mother.

He is allowed by most ancient authors to have excelled in poetry and music, particularly the latter; and that to such a degree, that he is represented as taming the most ferocious animals, changing the course of the winds by his melody, and as causing the trees of the forest to dance in concert with his lyre. This account, though we must suppose it fabulous, yet proves his excellence to have been great before he could have given rise to such fictions. He is said to have early cultivated the lyre, in preference to every other instrument: so that all those who came after him were contented to be his imitators; whereas, according to Plutarch, he adopted no model; for before his time no other music was known, except a few airs for the flute. Music was so closely connected in ancient times with the most sublime sciences, that Orpheus united it not only with philosophy, but with theology and legislation. He abstained from eating animal food; and held eggs in abhorrence as aliment, being persuaded that the egg subsisted before the chicken, and was the principle of all existence: both his knowledge and prejudices, it is probable, were acquired in Egypt, as well as those of Pythagoras many ages after.

Burney's Hist. of Music.

With respect to his abstaining from the flesh of oxen, Gesner supposes it may have proceeded from the veneration shown to that animal so useful in tillage, in the Eleusinian mysteries instituted in honour of Ceres, the goddess of agriculture. He might have added, that, as those mysteries were instituted in imitation of those established in Egypt in honour of Osiris and Isis, this abstinence from animal food was of the like origin, and a particular compliment to Apis. But Abbé Fragnir, in an ingenious dissertation upon the *Orphic Life*, gives still more importance to the prohibition; for as Orpheus was the legislator and humanizer of the wild and savage Thracians, who were cannibals, a total abolition of eating human flesh could only be established by obliging his countrymen to abstain from every thing that had life.

With respect to theology, Diodorus Siculus tells us, that his father Oeagrus gave him his first instructions in religion, imparting to him the mysteries of Bacchus, as they were then practised in Thrace. He became afterwards a disciple of the Idæi Dactyli in Crete, and there acquired new ideas concerning religious ceremonies. But nothing contributed so much to his skill in theological matters, as his journey into Egypt; where being initiated into the mysteries of Isis and Osiris, or of Ceres and Bacchus, he acquired a knowledge concerning initiations, expiations, funeral rites, and other points of religious worship, far superior to any one of his age and country. And being much connected with the descendants of Cadmus, the founder of Thebes in Bœotia, he resolved, in order to honour their origin, to transport into Greece the whole fable of Osiris, and apply it to the family of Cadmus. The credulous people easily received this tale, and were much flattered by the institution of the ceremonies in honour of Osiris. Thus Orpheus, who was held in great veneration at the Grecian Thebes, of which he was become a citizen, admirably adapted this fable, and rendered it respectable, not only by his beautiful verses and manner of singing them, but by the reputation he had acquired of being profoundly skilled in all religious concerns. Diodorus Siculus also says that he was a most attentive student in all kinds of literature, whether sacred or profane.

Diod. Siculus, lib. iv. cap. 25.

At his return into Greece, according to Pausanias, he was held in the highest veneration by the people, as they imagined he had discovered the secret of expiating crimes, purifying criminals, curing diseases, and appeasing the angry gods. He formed and promulgated an idea of a hell, from the funeral ceremonies of the Egyptians, which was received throughout all Greece. He instituted the mysteries and worship of Hecate among the Eginetes, and that of Ceres at Sparta.

Justin Martyr says, that he introduced among the Greeks near 360 gods; Hesiod and Homer pursued his labours, and followed the same clue, agreeing in the like doctrines, having all drank at the same Egyptian fountain.

Profane authors look upon Orpheus as the inventor of that species of magic called *evocation of the manes*, or raising ghosts; and indeed the hymns which are attributed to him are mostly pieces of incantation, and real conjuration. By all accounts he was an admirable musician: he is said to have received a lyre from Apollo, or according to some from Mercury, upon which he played with such a masterly hand, that even the most rapid rivers ceased to flow, the savage beasts of the forest

Orpheus. rest forgot their wildness, and the mountains came to listen to his song. All nature seemed charmed and animated, and the nymphs were his constant companions. Eurydice was the only one who made a deep impression on the melodious musician, and their nuptials were celebrated. Their happiness, however, was but short; for Aristæus became enamoured of her; and as she fled from her pursuer, a serpent that was lurking in the grass bit her foot, and she died of the poisoned wound. Her loss was severely felt by Orpheus, and he resolved to recover her or perish in the attempt. With his lyre in his hand, he entered the infernal regions, and gained an easy admission to the palace of Pluto. The king of hell was charmed with the melody of his strains; and according to the beautiful expressions of the poets, the wheel of Ixion stopped; the stone of Sisyphus stood still; Tantalus forgot his perpetual thirst, and even the furies relented. Pluto and Proserpine were moved with his sorrow, and consented to restore him Eurydice, provided he forbore looking behind him till he had come to the extremest borders of hell. The conditions were gladly accepted, and Orpheus was already in sight of the upper regions of the air, when he forgot his promise, and turned back to look at his long lost Eurydice.

All dangers past, at length the lovely bride
In safety goes, with her melodious guide;
Longing the common light again to share,
And draw the vital breath of upper air:
He first, and close behind him followed she;
For such was Proserpine's severe decree.
When strong desires th' impatient youth invade;
By little caution, and much love betrayed:
A fault which easy pardon might receive,
Were lovers judges, or could hell forgive.
For near the confines of etherial light,
And longing for the glimm'ring of a sight,
Th' unwary lover cast a look behind,
Forgetful of the law, nor master of his mind.
Straight all his hopes exhal'd in empty smoke;
And his long toils were forfeit for a look.

DRYDEN's Virgil.

He saw her, but she instantly vanished from his eyes: He attempted to follow her, but he was refused admission; and the only comfort he could find was to soothe his grief at the sound of his musical instrument in grottoes or on the mountains. He totally separated himself from the society of mankind; and the Thracian women, whom he had offended by his coldness to their amorous passion, or, according to others, by his unnatural gratifications and impure indulgencies, attacked him while they celebrated the orgies of Bacchus; and after they had torn his body to pieces, they threw his head into the Hebrus, which still articulated the words Eurydice! Eurydice! as it was carried down the stream into the Ægean sea. Others think, that, as he attempted to conjure his wife from the dead, which they understand by the story of his going down to hell, he thought he saw her; and when afterwards, on looking back he missed her, he died of grief. There is certainly some reason for supposing this to be the case: for there were persons and temples publicly appointed for the purpose; and Pausanias really speaks of that temple which was in Thesprotia, and where Orpheus went to call up the ghost of Eurydice. Poets often mention this subject; and instances of it occur in history both sacred and profane. The witch of Endor is well known to those who read the historical part of the Bible. But to particularise instances, whether sacred or profane, would be endless. Some maintain that he was killed by a thunderbolt. He was buried at Pieria in Macedonia, according to Apollodorus. The inhabitants of Dion boasted that his tomb was in their city, and the people of Mount Libethrus in Thrace claimed the same honour; and farther observed that the nightingales which built their nests near his tomb, sang with greater melody than all other birds. Orpheus, as some report, after death received divine honours; the muses gave an honourable burial to his remains, and his lyre became one of the constellations in the heavens.

Tzetzes explains the fable of his drawing his wife Eurydice from hell, by his great skill in medicine, with which he prolonged her life, or, in other words, snatched her from the grave. Æsculapius, and other physicians, have been said to have raised from the dead those whom they had recovered from dangerous diseases.

The bishop of Gloucester, in his learned, ample, and admirable account of the Eleusinian mysteries, says, "While these mysteries were confined to Egypt their native country, and while the Grecian lawgivers went thither to be initiated, as a kind of designation to their office, the ceremony would be naturally described in terms highly allegorical. This way of speaking was used by Orpheus, Bacchus, and others: and continued even after the mysteries were introduced into Greece, as appears by the fables of Hercules, Castor, Pollux, and Theseus's descent into hell; but the allegory was so circumstanced, as to discover the truth concealed under it. So Orpheus is said to get to hell by the power of his harp:

Threicia fretus cithara, fidibusque canoris.
VIRG. Æn. vi. ver. 119.

That is, in quality of lawgiver; the harp being the known symbol of his laws, by which he humanized a rude and barbarous people.—Had an old poem, under the name of *Orpheus*, intitled *A descent into Hell*, been now extant, it would perhaps have shown us, that no more was meant than Orpheus's *initiation*." See MYSTERIES.

Many ancient writers, in speaking of his death, relate, that the Thracian women, as hinted at above, enraged at being abandoned by their husbands, who were disciples of Orpheus, concealed themselves in the woods, in order to satiate their vengeance; and notwithstanding they postponed the perpetration of their design some time through fear, at length, by drinking to a degree of intoxication, they so far fortified their courage as to put him to death. And Plutarch assures us, that the Thracians stigmatized their women, even in his time, for the barbarity of this action.

Our venerable bard is defended by the author* of the *Divine Legation*, from some insinuations to his disadvantage in Diogenes Laertius. "It is true (says he), if uncertain report was to be believed, the mysteries were corrupted very early; for Orpheus himself is said to have abused them. But this was an art the debauched mystæ of later times employed to varnish their enormities;

* Warburton.

mities; as the detested pæderasts of after ages scandalized the blameless Socrates. Besides, the story is so ill laid, that it is detected by the surest records of antiquity; for in consequence of what they fabled of Orpheus in the mysteries, they pretended he was torn in pieces by the women; whereas it appeared from the inscription on his monument at Dium, in Macedonia, that he was struck dead with lightning, the envied death of the reputed favourites of the gods."

This monument at Dium, consisting of a marble urn on a pillar, was still to be seen in the time of Pausanias. It is said, however, that his sepulchre was removed from Libethra, upon Mount Olympus, where Orpheus was born, and from whence it was transferred to Dium by the Macedonians, after the ruin of Libethra by a sudden inundation which a dreadful storm had occasioned. This event is very minutely related by Pausanias.

Virgil bestows the first place in his Elysium upon the legislators, and *those who brought mankind from a state of nature into society:*

Magnanimi heroës, nati melioribus annis.

At the head of these is Orpheus, the most renowned of the European lawgivers, but better known under the character of a poet: for the first laws being written in measure, to allure men to learn them, and, when learnt, to retain them, the fable would have it, that by the force of harmony Orpheus softened the savage inhabitants of Thrace:

——*Threïcius longa cum veste sacerdos*
Obloquitur numeris septem discrimina vocum:
Jamque eadem digitis jam pectine pulsat eburno.
Æn. lib. vi. ver. 645.

The seven strings given by the poet in this passage to the lyre of Orpheus, is a circumstance somewhat historical. The first Mercurian lyre had, at most, but four strings. Others were afterwards added to it by the second Mercury, or Amphion: but, according to several traditions preserved by Greek historians, it was Orpheus who completed the second tetrachord, which extended the scale to a heptachord, or *seven sounds* implied by the *septem discrimina vocum.* For the assertion of many writers, that Orpheus added two new strings to the lyre, which before had seven, clashes with the claims of Pythagoras to the invention of the octachord, or addition of the sound *proslambanomenos* to the heptachord, of which almost all antiquity allows him to have been the inventor. And it is not easy to suppose, that the lyre should have been represented in ancient sculpture with four or five strings only, if it had had nine, so early as the time of Orpheus, who flourished long before sculpture was known in Greece. See the article Lyre.

With respect to the writings of Orpheus, he is mentioned by Pindar as author of the Argonautics, and Herodotus speaks of his Orphics. His hymns, says Pausanias, were very short, and but few in number: the Lycomides, an Athenian family, knew them by heart, and had an exclusive privilege of singing them, and those of their old poets, Musæus, Onomacritus, Pamphus, and Olen, at the celebration of the Eleusinian mysteries; that is, the priesthood was hereditary in this family.

Jamblicus tells us, that the poems under the name of *Orpheus* were written in the Doric dialect, but have since been transdialected, or modernised. It was the common opinion in antiquity that they were genuine; but even those who doubted of it, gave them to the earliest Pythagoreans, and some of them to Pythagoras himself, who has frequently been called the *follower of Orpheus*, and has been supposed to have adopted many of his opinions.

Of the poems that are still subsisting under the name of *Orpheus*, which were collected and published at Nuremberg 1702, by Andr. Christ. Eschenbach, and which have been reprinted at Leipsic 1764, under the title of ΟΡΦΕΩΣ ΑΠΑΝΤΑ, several have been attributed to Onomacritus, an Athenian, who flourished under the Pisistratidæ, about 500 years before Christ. Their titles are, 1. The Argonautics, an epic poem. 2. Eighty-six hymns; which are so full of incantations and magical evocation, that Daniel Heinsius has called them *veram Satanæ liturgiam*, "the true liturgy of the devil." Pausanias, who made no doubt that the hymns subsisting in his time were composed by Orpheus, tells us, that though less elegant, they had been preferred for religious purposes to those of Homer. 3. *De lapidibus*, a poem on precious stones. 4. Fragments, collected by Henry Stevens. Orpheus has been called the *inventor*, or at least the *propagator*, of many arts and doctrines among the Greeks. 1. The *combination of letters*, or the art of writing. 2. *Music*, the lyre, or *cithara*, of seven strings, adding three to that of Mercury. 3. *Hexameter verse*. 4. *Mysteries* and *theology*. 5. *Medicine*. 6. *Magic* and *divination*. 7. *Astrology*. Servius upon the sixth Æneid, p. 450. says, Orpheus first instituted *the harmony of the spheres*. 8. He is said likewise to have been the first who imagined a *plurality of worlds*, or that the moon and planets were inhabited.

Orpheus, in *Ichthyology*, the name of a fish caught in the Archipelago. It is of a broad and flat figure, and of a fine purple colour; its eyes are large and prominent, and its teeth serrated; it has only one fin on the back and the anterior rays of that are prickly, the others soft to the touch; its anus is small, and is said to have no passage for the semen.

This was the fish called *orpheus* by the ancients, but the modern Greeks call another fish by that name. It is a species of the sparus, of a flat figure, but very thick, has a small mouth, and is covered with small but very rough scales, which adhere very firmly to the flesh; the tail is not forked; it has fleshy lips, and very small teeth; its back and sides are black; its belly white: it has a large black spot at the root of the tail; its head is reddish, and its fins are very elegantly diversified with various colours; it has only one back-fin, and that has the anterior ray prickly, the hinder ones not at all so. It grows sometimes to 20 pounds weight, and is much esteemed among the modern Greeks.

ORPIMENT (*auripigmentum*), in *Natural History*, a mineral which is composed of sulphur and arsenic, found native in the earth, and constituting one of the ores of arsenic, but sometimes artificially prepared. It is of two kinds, red and yellow. See Arsenic, Mineralogy *Index*, and Arsenic under Ores, *Reduction of*.

ORPINE. See Sedum, Botany *Index*.

ORRERY, a curious machine for representing the motions or phases of the heavenly bodies. See ASTRONOMY, p. 171.

The reason of its being called an *Orrery* was this: Mr Rowley, a mathematical instrument maker, having got one from Mr George Graham, the original inventor, to be sent abroad with some of his own instruments, he copied it, and made the first for the earl of Orrery. Sir Richard Steele, who knew nothing of Mr Graham's machines, thinking to do justice to the first encourager, as well as to the inventor of such a curious instrument, called it an *Orrery*, and gave Mr Rowley the praise due to Mr Graham.

ORRERY, *Earls of.* See BOYLE.

ORRICE. See IRIS, BOTANY *Index*.

ORTEGAL, CAPE, the most northern promontory of Spain, where there is also a castle of the same name. W. Long. 8. 20. N. Lat. 44. 0.

ORTELIUS, ABRAHAM, a celebrated geographer born at Antwerp, in 1527, was well skilled in the languages and the mathematics, and acquired such reputation by his skill in geography, that he was surnamed the *Ptolemy of his time*. Justus Lipsius, and most of the great men of the 16th century, were Ortelius's friends. He resided at Oxford in the reign of Edward VI. and came a second time into England in 1577. His *Theatrum Orbis* was the completest work of the kind that had ever been published, and gained him a reputation equal to his immense labour in compiling it. He also wrote several other excellent geographical works; the principal of which are his *Thesaurus*, and his *Synonyma Geographica*. The world is likewise obliged to him for the *Britannia*, which he persuaded Camden to undertake. He died at Antwerp in 1598.

ORTHEZ, a city in France, in the department of the lower Pyrenees, and before the Revolution, a bishop's see. Its population in 1800 was 6738. The cathedral is a wretched edifice, very ancient, built in a barbarous style, and almost in ruins. The remains of the castle of Orthez are very noble, and its situation is fine, on a hill which commands the town and a great extent of country. The people call it *Le Chateau de la Reine Jeanne*, because that queen resided in it during many years, in preference to the castle of Pau. The princess Blanche, daughter to John king of Arragon and Navarre, was shut up, and died here, in 1464. Her brother being dead, she became heiress to the crown of Navarre; but her father having delivered her into the hands of her younger sister Leonara countess of Foix, she confined the unhappy Blanche in the castle of Orthez, and, after am imprisonment of two years, caused her to be poisoned.

ORTHODOX, in church history, an appellation given to those who are sound in all the articles of the Christian faith.

ORTHOGRAPHIC PROJECTION *of the* SPHERE, that wherein the eye is supposed to be at an infinite distance; so called, because the perpendiculars, from any point of the sphere, will all fall in the common intersection of the sphere with the plane of the projection. See GEOGRAPHY and PROJECTION.

ORTHOGRAPHY, that part of grammar which teaches the nature and affections of letters, and the just method of spelling or writing words, with all the proper and necessary letters, making one of the four greatest divisions or branches of grammar. See GRAMMAR.

ORTHOGRAPHY, in *Geometry*, the art of drawing or delineating the fore-right plan of any object, and of expressing the heights or elevations of each part. It is called *Orthography*, for its determining things by perpendicular lines falling on the geometrical plane.

ORTHOGRAPHY, in *Architecture*, the elevation of a building.

ORTHOGRAPHY, in *Perspective*, is the fore-right side of any plane, i. e. the side or plane that lies parallel to a straight line, that may be imagined to pass through the outward convex points of the eyes, continued to a convenient length.

ORTHOPNOEA, a species or degree of asthma, where there is such a difficulty of respiration that the patient is obliged to sit or stand upright in order to be able to breathe. See MEDICINE *Index*.

ORTIVE, in *Astronomy*, the same with eastern. The ortive or eastern amplitude, is an arch of the horizon intercepted between the place where a star rises, and the east point of the horizon, or point where the horizon and equator intersect.

ORTNAU or ORTENAU, a district or canton in Germany, in Suabia, lying along the Rhine opposite Strasburg. It included eight or ten small towns, of which Offenburg, Gegensbach, and Zell, were the most considerable: these towns formed a small federation, and held immediately of the empire. At the distribution of the indemnities, after the peace of Luneville, this territory, with the Brisgaw, was assigned to the duke of Modena; but the greater part of it was afterwards annexed to the grand duchy of Baden.

ORTOLAN. See EMBERIZA, ORNITHOLOGY *Index*.

ORTYGIA, the birthplace of Diana, was a beautiful grove of trees of various kinds, chiefly cypresses, near Ephesus; on the coast, a little up from the sea. This place was filled with shrines and images. The priests of the goddess were eunuchs, and exceedingly respected by the people. A general assembly was held there yearly, and splendid entertainments were provided, and mystic sacrifices solemnized. The Cenchrius, probably a crooked river, ran through it; and above it was the mountain Solmissus, on which, it was fabled, the Curetes stood, and rattled on their shields, to divert the attention of Juno. The improved face of a country is perishable like human beauty. Not only the birthplace of Diana and its sanctity are forgotten, but the grove and buildings which adorned it appear no more; and perhaps, says Dr Chandler, the land has encroached on the sea, and the valley, in which Arvisia is, was once Ortygia. See EPHESUS, and DIANA, &c.

ORVIETO, a town of Italy, in the patrimony of St Peter, with a bishop's see, and a magnificent palace. It is the capital of the province of Orvietano, in the ecclesiastic state, in E. Long. 12. 5. Lat. 42. 50. It is a large strong town, situated at the conflux of the Paglia and the Chiane, on a steep hill, surrounded on every side with rocks and precipices. To this situation it is owing that it has no springs; but there is a very surprising well cut into the rock, to supply it with fresh water. The mules, which bring up the water on their backs, go down by a staircase of 150 steps, and 60 windows, and come up by another, without meeting. The architect

of

of this singular building was the famous Antonio de San Gallo, employed by Clement VII. At the entrance is this inscription, *Quod natura munimento inviderat, industria adjecit.* This city, called *Herbanum* by Pliny, and *Urbecetanum* by Procopius, is the see of a bishop suffragan of Rome. The cathedral, which is of Gothic architecture, is a handsome building, which was begun in 1260 by Nicolo Pisano. The front is adorned with fine statues, among the rest the Virgin Mary and the four Evangelists, with a basso-relievo of the last judgement, by the said Nicolo Pisano, and others representing some histories of the Old Testament. The other half of the front is a surprising work in mosaic, by Scalzi, expressing the history of the New Testament. In the church there is a very fine organ, and a basso-relievo of Raphael da Monte Lupo. Here is also a chapel, which was begun to be painted by F. Angelo, a dominican, and finished by Luke Signorelli, where you see a very beautiful representation of the last judgment. Orvieto was once a potent and populous city, but is now much upon the decline.

ORYZA, Rice, a genus of plants belonging to the hexandria class, and in the natural method ranking under the 4th order, *Gramina*. See Botany *Index*.

There is but one species, namely the sativa, or common rice. This plant is greatly cultivated in most of the eastern countries, where it is the chief support of the inhabitants; and great quantities of it are brought into England and other European countries every year, where it is much esteemed for puddings, &c. it being too tender to be produced in these northern countries without the assistance of artificial heat; but from some seeds which were formerly sent to Carolina there have been great quantities produced, and it is found to succeed as well there as in the east.

This plant grows upon moist soils, where the ground can be flowed over with water after it is come up. So that whoever would cultivate it in this country should sow the seeds upon a hot-bed; and when the plants are come up, they should be removed into pots filled with light rich earth, and placed in pans of water, which should be plunged into a hot-bed; and, as the water wastes, it must from time to time be renewed again. In July these plants may be set abroad in a warm situation, still preserving the water in the pans, otherwise they will not thrive; and, toward the latter end of August, they will produce their grain, which will ripen tolerably well, provided the autumn proves favourable. The leaves of rice are long, like the reed, and fleshy; the flowers blow on the top like barley; but the seed which follows is disposed in clusters, each of which is inclosed in a yellow husk, ending in a spiral thread. The seed is oblong, or rather oval, and white.

Rice is the chief commodity and riches of Damietta in Egypt. Dr Hasselquist gives the following description of the manner in which they dress and separate it from the husks. "It is pounded by hollow iron pestles of a cylindrical form, lifted up by a wheel worked by oxen. A person sitting between the two pestles, pushes forward the rice when the pestles are rising; another sifts, winnows, and lays it under the pestles. In this manner they continue working it until it is entirely free from chaff and husks. When clean, they add a 30th part of salt, and pound them together; by which the rice, formerly gray, becomes white. After this purification, it is passed through a fine sieve to part the salt from the rice; and then it is ready for sale." Damietta sells every year 60,800 sacks of rice, the greatest part of which goes to Turkey, some to Leghorn, Marseilles, and Venice.

ORYZIVORA, called the rice-bird of Catesby, a species of emberiza, which see, Ornithology *Index*.

OSCHOPHORIA, a festival celebrated by the Athenians, which receives its name απο του φερειν τας οσχας, "from carrying boughs hung up with grapes," called οσχαι. The original institution is thus mentioned by *Plut. in Thes.* Theseus, on returning from Crete, forgot to hang out the white sail, by which his father was to be apprized of his success. This neglect proved fatal to Ægeus, for he threw himself into the sea, and perished. Theseus no sooner reached the land, than he sent a herald to inform his father of his safe return, and in the mean time he began to make the sacrifices which he had vowed to make when he first set sail from Crete. The herald, on his entrance into the city, found the people in great agitation. Some lamented the king's death, while others, elated at the sudden news of the victory of Theseus, crowned the herald with garlands in token of their joy. The herald carried back the garlands on his staff to the sea shore; and, after waiting till Theseus had finished his sacrifice, he related the melancholy account of the king's death. Upon this the people ran in crowds to the city, showing their grief by cries and lamentations. From this circumstance, therefore, at the feast of Oschophoria, not the herald but his staff is crowned with garlands, and all the people that are present always exclaim ελελευ, ιυ, ιυ, the first of which expresses haste, and the others a consternation or depression of spirits. The historian further mentions, that Theseus, when he went to Crete, did not take with him the usual number of virgins, but that in the place of two of them, he took two youths of his acquaintance, whom he caused to pass for women, by disguising their dress, and by accustoming them to the ointments and perfumes of women, as well as by a long and successful imitation of their voice. The imposition succeeded; their sex was not discovered in Crete; and when Theseus had triumphed over the Minotaur, he with these two young men led a procession, with branches in their hands in the same habit, which is still used at the celebration of the festival. The branches which were carried were in honour of Bacchus or Ariadne, or because they returned in autumn, when the grapes were ripe. Besides this procession, there was also a race, in which young men only whose parents were both alive were permitted to engage. It was customary for them to run from the temple of Bacchus to that of Minerva, which was on the sea shore. The place where they stopped was called οσχοφοριον, because the boughs which they carried in their hands were deposited there. The reward of the conqueror was a cup called πενταπλοα, "five-fold," because it contained a mixture of five different things, wine, honey, cheese, meal, and oil.

OSCILLA, small images of wax or clay made in the shape of men or women, and consecrated to Saturn, to render him propitious. The word is sometimes used to signify a kind of masks scooped from the bark of trees, and worn by the performers of comedy in the ruder ages of Rome. In this sense we find it in Virg. Georg. ii. 386. It also signifies little heads or images of

Bacchus, which the country men of old hung upon trees, that the face might turn every way, out of a notion that the countenance of this god gave felicity to themselves, and fertility to their vineyards. An allusion to this opinion and custom is also found in Virgil, Georg. ii. 388.

OSENEY-ISLAND, in England, is formed by the river Isis, in the meadows near Oxford, where a magnificent abbey was erected, at the instigation of a concubine of King Henry I. to atone for her sins; and the said king built a palace there, wherein King Richard I. was born, which Edward II. converted into a monastery.

OSIRIS, in *Mythology*, one of the gods of ancient Egypt, and very generally believed to have been the sun, or at least the mind actuating that luminary.

The Egyptians derived all things from two principles, an *active* and a *passive*. Their active principle, according to the learned Jablonski*, was an infinite and eternal *spirit;* and their passive principle was *night*. This spirit they considered sometimes as a *male*, sometimes as a *female*, divinity, and occasionally they attributed to it *both sexes;* but it does not appear to have been the object of their worship. It shall be shown elsewhere (see POLYTHEISM), that the earliest objects of pagan adoration were the sun, moon, and planets: and that the philosophers and priests of ancient Egypt worshipped the sun by the name of *Osiris*, may be proved by numberless testimonies from the most authentic records of antiquity. Diogenes Laertius affirms, that they held the sun and moon for divinities, and that they called the latter *Isis;* and Macrobius says expressly, "Nec in occulto est, neque aliud esse *Osirin* quam *solem*, nec *Isim* aliud esse quam *terram*." The same writer informs us, that in the hieroglyphic writings of ancient Egypt, "Osiris was represented by a sceptre and an eye," to denote that this god was the *sun* looking down from heaven on all things upon earth.

* Panth. Ægypt.

It must not, however, be concealed, that some of the ancients, and a few of the most learned moderns, have contended, that by *Osiris* the Egyptians understood the Nile or spirit of the Nile, whilst others have confounded him with the Grecian Bacchus. Scaliger and Selden have adopted the former of these opinions, and Servius on Virgil has given his countenance to the latter. But that they are all mistaken, has been evinced by Jablonski in such a manner as to enforce the fullest conviction: "When the Egyptians, in their sacred books, sometimes gave the name of *Osiris* to the Nile and its wonderful increase during the heat of summer, they mean nothing more (says he) but to attribute to their god Osiris the gift which fertilizes their country." This they would the more readily do that they believed the Nile to have its source in heaven. Hence Eusebius tells us †, Οσιρις εστιν ὁ Νειλος, ὃν εξ ουρανου καταφερεσθαι οιονται, *Osiris is the Nile, because they think it is sent down from heaven.* In one sense Osiris might be Bacchus, because the original Bacchus was himself the sun (see MYSTERIES, N° 12.); but that the Egyptian god could not be worshipped as the inventor of wine is indeed undeniable, if, as Jablonski labours to prove, the primitive religion of that country inculcated upon its votaries, that wine was the gift, not of a benevolent god, but of an evil genius, the enemy of the human race. In support of this opinion our learned author quotes a passage from Plutarch, from which it appears, that, before the era of Psammetichus, the Egyptians neither drank wine themselves, nor offered it in libations to the gods, because they believed that the first vine sprung from the earth was impregnated by the blood of those giants who perished in the war with the gods. It is indeed true, that the Greeks, who borrowed their religion as well as the first principles of science from Egypt, attributed to their Bacchus many of the actions of Osiris; but it is likewise true, that they gave him other attributes, which the Egyptian god could not possess, consistently with the known superstitions of that country. Salmasius, however, attempts to prove, from the import of the name, that the *Osiris* of Egypt must have been the Bacchus of Greece. Σηρ or Σιρι, he says, signifies a *son* in the Egyptian language; and hence he concludes that the god was by that people called *Osiris*, for the same reason that by the Greeks he was called Κουρος, and by the Romans *Liber*. But this seems all to be a mistake. *Siris* makes a part of many Egyptian proper names, as *Bu-siris*, *Termo-siris*, *Tapo-siris*, &c. and is in all probability derived from the Hebrew word *Sar*, *Sur*, or *Sir*, which signifies a *prince*, *potentate*, or *grandee*. As the name of the god was in Egypt not *Osiris*, but *Isiris* or *Ysiris*, it was probably made up of *Sir* or *Siris*, and the Hebrew prefix *I* or *ish*, denoting *strength;* so that the whole word will signify the *strong* or *mighty prince*. If so, we cannot doubt, as Diodorus Siculus, Eusebius, Sextus Empiricus, &c. all affirm, that the Egyptians worshipped the sun by the name of *Osiris*, but that by this name they meant the *power* or *governing mind* of the sun, as the Greeks and Romans seem to have done by their *Phœbus* and *Apollo*.

† Prepar. Evangel.

But though the original Osiris was undoubtedly the sun, or the intelligence actuating the sun, yet there is reason to believe that there was a *secondary Osiris*, who at a very early period reigned in Egypt, and was deified after his death for the benefits he had rendered to his country (see POLYTHEISM). This is indeed so generally admitted, as to have occasioned great controversies among the learned respecting the time when he flourished, and whether he was the civilizer of rude barbarians or the victorious sovereign of a polished nation. The illustrious Newton it is well known, has adopted the latter opinion; and with much plausibility endeavoured to prove, that *Osiris* was the same with *Sesostris* or *Sesac:* but it must be confessed, that his conclusion is contrary to all the most authentic records of antiquity; and that it would be easy, by the same mode of arguing, to give a show of identity to two persons universally known to have flourished in very distant ages (A). The annals of Egypt, as may be seen in the writings of Herodotus, Diodorus Siculus, Strabo, Plutarch, and others, who copied

(A) This has been in fact done by Warburton; who employs Newton's mode of reasoning with equal plausibility, and perhaps superior force, to prove the identity of King Arthur and William the Conqueror. See *Divine Legation of Moses*, vol. iii. book. iv. sect. v.

pied from those annals, expressly asserted the distinct personality of Osiris and Sesostris, and placed them in æras vastly distant from each other. Osiris, if any credit be due to those historians, was the founder of the Egyptian monarchy; and, as was customary in those days, having either received the name of the sun, or communicated his own to that luminary, was after his death deified for the benefits which he had rendered to his country: and being at first worshipped only as a demigod, was in process of time advanced to full divinity, and confounded with his heavenly godfather. The Greeks, who, though original in nothing, were always prompted by their vanity to hold themselves out as the first of the nations, claimed this Osiris as their own, and pretended that he was the son of Jupiter and Niobe. He reigned, say they, over the Argives; but afterwards delivered his kingdom to his brother Algialeus, and took a voyage into Egypt, of which he made himself master, and married Io or Isis. He established good laws there; and they were both after their deaths worshipped as gods. That this is a ridiculous fiction needs no proof; since every one knows, that good laws were established in Egypt long before the Argives had any king, or indeed existed either as a tribe or nation.

OSMUNDA, Moonwort; a genus of plants belonging to the cryptogamia class. See Botany *Index*.

OSNABURG, a bishopric of Germany, situated in the centre of the circle of Westphalia, between the Weser and the Ems, having Minden on the east, Munster on the west, Diepholt on the north-east, and Ravensburg on the south-west. It is about 45 miles long and 25 broad, producing some rye, several sorts of turf, coals, marble, and good pasturage. The inhabitants, who are a mixture of Protestants and Roman Catholics, breed a considerable number of cattle, especially hogs, of which they make excellent bacon and hams; but a great part of the country consists of heaths. By the treaty concluded here in 1648, the bishopric was to be an alternative between the Roman Catholics and Lutherans; and the Lutheran bishop was to be a younger prince of the house of Brunswick Lunenburg, or in failure thereof, of Brunswick Wolfenbuttle. In consequence of this settlement, it has been twice held by a British prince since the accession of the family of Hanover. In 1802 this bishopric was secularized and added to Hanover on certain conditions, and now forms a part of that kingdom. The bishopric had a population of about 130,000 souls. Of the peasants, 6000 go yearly to Holland, where they mow, till, cut turf, and do other work for hire. The meanest of them brings home twenty, and the best workmen seventy florins. Bishop Ernest established a salt-work at Dissen; and the same bishop opened a silver mine, but this undertaking was not prosecuted. The chief manufactures of the country are a coarse kind of linen cloth and yarn, which are said to bring into it annually about 1,000,000 of rixdollars. There are also some woollen manufactures in Osnaburg and Bramsche. The land estates of the bishopric were, the chapter, the knights, and the four towns. The diets were held at Osnaburg, when called together by the bishop. The count of Bar was hereditary seneschal or steward, and president of the college of knights. The bishop was a prince of the empire; and in the matricula is rated at six horse and 36 foot, or 216 florins monthly, in lieu of them. To the chamber of the empire he contributed each term 81 rixdollars, 14 kruitzers and a half. The capital of this bishopric is

Osnaburg, or *Osnabruck*. It was formerly an imperial city, and one of the Hanse towns. It has its name from a bridge over the river Hase, or Ose, which divides it into the Old and New Town, and stands 75 miles west of Hanover, and 30 north-east of Munster, being surrounded with walls and ditches, but commanded by a mountain within cannon shot. It stands in a fine plain, and is adorned with several good buildings, and on the mountain there is an abbey. The magistracy of this city, which is rechosen yearly on the 2d of January, is Lutheran; and the churches belong, some to the Lutherans, and some to the Papists. Both parties have the full and free exercise of their religion, whether the bishop be Protestant or Papist. The bishop's palace, called *Petersburgh*, was built by Bishop Ernest Augustus, brother to King George I. It is well fortified and separated from the town by a bridge. It is a hexagon, with a court in the middle, and at each corner a turret. In the town-house are still preserved the pictures of the plenipotentiaries that assisted at the conferences there for the famous treaty of Westphalia. In the treasury of the cathedral are still to be seen some ornaments given by Charlemagne, as also his crown, which is only of silver gilt, and his comb and batoon, six feet in length, both of ivory; together with other curiosities. Charlemagne is said to have erected here a school for Latin and Greek, which the Jesuits in 1625 converted into an academy. They have the best bread and beer that is to be met with in all Westphalia, and have a pretty good trade in bacon and linen; as also by brewing a palatable thick sort of beer called *buse*. This city is noted for a treaty betwixt the emperor and the king of Sweden in 1648, wherein the affairs of the Protestants were regulated, which was a branch of the treaty of Westphalia. In 1613 the greatest part of it was destroyed by fire. In 1630 Bishop Francis William erected an academy here, consisting of thirteen seminaries, which were also confirmed by the emperor Ferdinand II., and Pope Urban VIII.; but the capture of the place by the Swedes in 1733 put an end to it. In 1634 the crown of Sweden created Count Gustavus Wasaburg lord of the bishopric of Osnaburg; but at the peace of Osnaburg he renounced all his right obtained over this place during the war, in consideration of receiving 80,000 rix dollars. The town toll was by the town, in the year 1431, given to the bishop, with a reserve of exemption from toll to the burghers, in order to get rid of the Jews, who were that year banished. The cathedral is in the hands of the Roman Catholics, with the church and monastery of the Dominicans in the old city, and the collegiate church of St John in the new. The Protestants are masters of the great parochial church of St Mary in the old city; and both religions have a voice in the election of the magistrates. The bishop's palace is fortified like a castle: here it was that George I. was born on the 28th of May 1660, his father Ernest Augustus being then bishop and prince of the place; and here also he died in the night of the 10th of June 1727, and, as some say, in the very room in which he was born. The inhabitants have considerable manufactures

nufactures of linen and a good breed of cattle; and of their hogs, for which they are remarkable, is made the best Westphalia bacon. Not far from this city are to be seen the ruins of an old church and castle called *Beclem*, which some say was built by King Witekind upon his conversion; and about two miles from it lies the monastery of Rulle, on the bank of a lake so deep, that report says it could never yet be fathomed. This was the first town in Westphalia which received the Lutheran doctrine.

Osnaburg Island, one of the islands in the South sea, discovered by Captain Wallis in 1767. It is a high, round island, not above a league in circuit; in some parts covered with trees, in others a naked rock. S. Lat. 22. 48. W. Long. 14. 34.

OSORIUS, Jerome, a Portuguese ecclesiastic, was born of a noble family at Lisbon, in 1500. He was educated at the university of Salamanca, and afterwards studied at Paris and Bologna. On his return to Portugal he gradually rose to the bishopric of Sylves, to which he was appointed by Catharine of Austria, regent of the kingdom in the minority of Sebastian. At the request of Cardinal Henry of Portugal, he wrote his history of King Emanuel, and the Expedition of Gama; which his great contemporary Camoens made at the same time the subject of his immortal Lusiad; a poem which has at length appeared with due lustre in our language, being translated with great spirit and elegance by Mr Mickle. It is remarkable that the history of Osorius, and the epic poem of Camoens, were published in the same year, 1572: but the fate of these two great authors were very different; the poet was suffered to perish in poverty, under the reign of that Henry who patronised the historian: yet allowing for the difference of their professions, they possessed a similarity of mind. There appear many traces of that high heroic spirit even in the priest Osorius, which animated the soldier Camoens; particularly in the pleasure with which he seems to describe the martial manners of his countrymen under the reign of Emanuel. "In that age (says the historian in the close of his manly work), poverty and sadness were banished from Portugal. Complaints were never heard; but every place, from the court to the cottage, resounded with mirth and music. Illicit love was unknown; nor would the ladies listen to the most honourable addresses of such youths as had not signalized themselves in war. No young man about court, however noble by birth, was permitted to wear the dress of manhood till he had passed over into Africa, and thence brought back with him some animal esteemed for its rarity; and such was the hardy education of the nobility in that age, that many of them travelled everywhere in quest of adventures." This is a striking picture of the manners of chivalry, to which Portugal owed much of its glory in that splendid period. There is one particular in the character of Osorius, which, considering his age and country, deserves the highest encomium; and that is his tolerating spirit. In the first book of his history, he speaks of Emanuel's cruel persecution of the Jews in the following generous and exalted language: "This (says he) was authorized neither by law nor by religion. Can men be compelled to believe what they reject with abhorrence? Do you take upon you to restrain the liberty of the will, or to fetter the understanding? Such an attempt must be unsuccessful; and is not acceptable to Christ, who expects from man devotion of the heart, and not that formal worship which is the offspring of pains and penalties. He wishes them to study his religion, and accept it from conviction, not from terror: for who does not see that forced belief is mere hypocrisy?" Osorius is said to have used many arguments to dissuade Sebastian from his unfortunate expedition into Africa, and to have felt so deeply the miseries which befel the Portuguese after that fatal event, that his grief was supposed to accelerate his death. He expired in 1580, happy, says De Thou (who celebrates him as a model of Christian virtue), that he died just before the Spanish army entered Portugal, and thus escaped being a witness to the desolation of his country.—His various works were published at Rome in 1592, by his nephew Osorius, in four volumes folio, with a life of their author. Among these are two remarkable productions; the first, An Admonition to our Queen Elizabeth, exhorting her to return into the Church of Rome; the second, An Essay on Glory, written with such classical purity, as to give birth to a report, that it was not the composition of Osorius, but the last work of Cicero on that subject.

OSPREY. See Falco, Ornithology *Index*.

OSSA, a lofty mountain of Thessaly, near the Peneus, which runs between this mountain and Olympus; famous in the fabulous story of the giants (Homer, Virgil, Horace, Seneca, Ovid). The bending and unbending of its pines, on the blowing of a strong north wind, formed a clashing sound like thunder (Lucan). It was once the residence of the Centaurs, and was formerly joined to Mount Olympus; but Hercules, as some report, separated them, and made between them the celebrated valley of Tempe. The separation of the two mountains was more probably effected by an earthquake which happened about 1885 years before the Christian era. Its greatest celebrity arises from its being one of those mountains which the giants in their wars against the gods heaped up one on the other to scale the heavens with more facility. A town of Macedonia.

OSSAT, Arnauld de, a learned French ecclesiastic, was born in the diocese of Auch in 1536, of mean parentage, and was taken notice of by a gentleman in the diocese, who made him study with his ward the Lord of Castlenan de Magnoac. He studied the law at Dijon under Cujace, and applied himself to the bar at Paris. He was secretary at Rome to M. de Foix, archbishop of Thoulouse; to Cardinal Este; and afterwards to Cardinal de Joyeuse, by the French king's express command. After rising to the highest dignities both in church and state, in 1599 he was created a cardinal by Pope Clement VIII. He died in 1604. An eminent French writer gives him the following character: "He was a man of prodigious penetration; applied himself so closely to affairs, and especially was so judicious in forming his resolutions, and it is almost impossible to find out one false step in the many negociations in which he was concerned. His works, and especially his letters, have been much esteemed in the learned world.

OSSIAN, the son of Fingal, a celebrated Celtic poet, who flourished about the end of the second and

Ossian. beginning of the third century. Several incidents in his poems point out this as his æra: particularly the engagement of Fingal with Caracul, or Caracalla, the son of the emperor Severus, styled by Ossian, *The Son of the King of the World*. M. Tillemont fixes the elevation of Caracalla to a share in the government to the year 198, and the association of his brother Geta to 208. About which time Gibbon fixes the Caledonian war, and speaks thus upon the subject: "This Caledonian war, neither marked by decisive events, nor attended with any important consequences, would ill deserve our attention; but it is supposed, not without a considerable degree of probability, that the invasion of Severus is connected with the most shining period of the British history or fable. Fingal, whose fame, with that of his heroes and bards, has been revived in our language by a recent publication, is said to have commanded the Caledonians in that memorable juncture, to have eluded the power of Severus, and to have obtained a signal victory on the banks of the Carun, in which the *son of the King of the World*, Caracul, fled from his arms along the fields of his pride †. Something of a doubtful mist still hangs over these Highland traditions; nor can it be entirely dispelled by the most ingenious researches of modern criticism (A); but if we could with safety indulge the pleasing supposition that Fingal lived, and that Ossian sung, the striking contrast of the situation and manners of the contending nations might amuse a philosophic mind. The parallel would be little to the advantage of the more civilized people, if we compared the unrelenting revenge of Severus with the generous clemency of Fingal; the timid and brutal cruelty of Caracalla, with the bravery, the tenderness, the elegant genius of Ossian; the mercenary chiefs who, from motives of fear or interest, served under the imperial standard, with the free-born warriors who started to arms at the voice of the king of Morven: if, in a word, we contemplated the untutored Caledonians glowing with the warm virtues of nature, and the degenerate Romans polluted with the mean vices of wealth and slavery."

† *Ossian's Poems*, vol. i. p. 175.

The date of this action, if the poems be true, is rather confounding; for the next expedition, which is produced to fix the time in which Ossian flourished, was conducted by Oscar (against the usurper Carausius, the Caros of Ossian), who did not assume the purple till so late as the year 287. This account indeed corresponds pretty well with the account given by Irish histories, which place the death of Fingal in the year 283, and that of Oscar (who died many years before his father Ossian) in the year 296. These hints are not thrown out because we think they militate against the authenticity of the poems; for distant though these dates be, it is yet possible to reconcile them. Old age was and is very common in those regions; and Ossian himself, we are told, was an instance of great longevity. Indeed at such a distance of time, it cannot be expected that we should give either a very particular or a very exact account of Ossian and his heroes. Were there no doubts remaining of the truth of the facts, it is still natural to suppose that they must have suffered obscurity through the rust of time, and above all through the neglect of the poems, which till lately were unknown.

The first expedition on which Ossian's father sent him was, to raise a stone on the banks of Crona, to perpetuate the memory of a victory which the king of Morven had obtained at that place. The Highlanders talk of this as being emblematical of that immortality which heroes were to receive from his future compositions. In this expedition he was accompanied by Toscar, father of the beautiful Malvina, the amiable companion of his grief, after the death of her beloved Oscar, his son. It appears from his poems, that in one of his early expeditions to Ireland, he had fallen in love with and married Evirallin, daughter to Branno, petty king of Lego. "I went in suit of the maid of Lego's sable surge; twelve of my people were there, the sons of streamy Morven. We came to Branno, friend of strangers; Branno of the sounding mail.—'From whence (he said) are the arms of steel? Not easy to win is the maid that has denied the blue-eyed sons of Erin. But blest be thou, O son of Fingal! happy is the maid that waits thee. Though twelve daughters were mine, thine were the choice, thou son of fame.'—Then he opened the hall of the maid; the dark-haired Evirallin †." This Evirallin was the mother of his son Oscar, whose exploits he celebrates in many of his poems, and whose death he laments in the first book of Temora. Evirallin died some time before Oscar (FINGAL, B. iv.), who seems to have been her only child; and Ossian did not marry afterwards; so that his posterity ended in the death of Oscar; who seems to have died as he was about to be married to Malvina, the daughter of Toscar. Several of her lamentations for her lover are recorded by Ossian, which paint her grief in the strongest and most beautiful colours. "It is the voice of my love! few are his visits to my dreams.—But thou dwellest in the soul of Malvina, son of mighty Ossian. My sighs arise with the beams of the east; my tears descend with the drops of night. I was a lovely tree in thy presence, Oscar, with all my branches round me: but thy death came like a blast from the desert, and laid my green head low; the spring returned with its showers, but no green leaf of mine arose." *Poem of* COMRA.

† *Fingal*, B iv.

The principal residence of Ossian was in the vale of Cona, now Glenco, in Argyleshire. See FINGAL.

His poems relate many of his expeditions to Ireland,

(A) "That the *Caracul* of Ossian is the *Caracalla* of the Roman history, is perhaps the only point of British antiquity in which Mr Macpherson and Mr Whitaker are of the same opinion; and yet the opinion is not without difficulty. In the Caledonian war, the son of Severus was known only by the appellation of *Antoninus;* and it may seem strange that the Highland bard should describe him by a nickname, invented four years afterwards, scarcely used by the Romans till after the death of that emperor, and seldom employed by the most ancient historians. See Dion. lib. lxxvii. p. 1317. Hist. August. p. 89. Aurel. Victor. Euseb. in Chron. ad ann. 214.

land, Scandinavia, Clyde, and Tweed or Teutha. His exploits on these occasions, after making a large allowance for poetical exaggeration, show him to have been no less a warrior than a poet: (See OSSIAN'S WORKS, in the poems *Calthon and Colmal*, *Lathmon*, *Berrathon*, &c.). By these xpeditions, which were always undertaken for the relief of the distressed, the mind of Ossian seems to have been cultivated and enlarged beyond what is usually to be met with in so rude a period of society as that in which he lived. His poems breathe, throughout, such a spirit of generosity and tenderness, especially towards the fair sex, as is seldom or never to be met with in the compositions of other poets who lived in a more advanced state of civilization. He lived to an extreme old age; having survived all his family and friends, many of whom perished by a fatal accident, recorded in one of his poems called the *fall of Tura* *. Malvina alone, the love of his son Oscar, remained with him till within a few years of his death, and paid him every attention that could be expected from the tender relation in which she stood to him. To her he addresses many of his poems, which seem to have been composed for the most part in his old age. Her death is pathetically lamented by him in the poem of *Berrathon*: towards the close of which, he gives the presages of his own departure; an event which he often wishes for, under the blindness and other calamities of his declining years. "Roll on, ye dark brown years, for ye bring no joy on your course. Let the tomb open to Ossian, for his strength has failed. The sons of the song are gone to rest: my voice remains, like a blast, that roars lonely, on the sea surrounded rock, after the winds are laid. The dark moss whistles there, and the distant mariner sees the waving trees †."—"But Ossian is a tree that is withered. Its branches are blasted and bare; no green leaf covers its boughs. From its trunk no young shoot is seen to spring. The breeze whistles in its gray moss: the blast shakes its head of ages.—The storm will soon overturn it, and strew all its dry branches with thee, O Dermid! and with all the rest of the mighty dead, in the green winding vale of Cona ‡."

* See *Gaelic Antiquities*.

† Poem of *Berrathon*.

‡ *Gaelic Antiquities*, poem of *Dermid*.

It is not certain at what age Ossian died; but from his having been long blind with years, and from the many contrasts between his present and past situations, in poems composed, as it would appear, at a considerable distance of time from each other, it is most likely he lived to an extreme old age. The current tradition is, that he died in the house of a Culdee, called the *Son of Alpin*, with whom he is said to have held several conferences about the doctrines of Christianity. One of these dialogues is still preserved, and bears the genuine marks of a very remote antiquity; (*Dissertation* prefixed to *Ossian's Works*). Several of Ossian's poems are addressed to this son of Alpin, who was probably one of those Christians whom the persecution under Dioclesian had driven beyond the pale of the Roman empire.

The poems of Ossian, though always held in the highest esteem by those who knew them, were allowed to remain in the obscurity of their original Gaelic, till Mr Macpherson, above 40 years ago, translated a collection of them into English, which immediately attracted the attention of every person who had a true taste for poetry. Dr Blair, in particular, introduced these poems into the world with those critical remarks which do no less honour to himself than to the poet. According to that eminent critic, the two great characteristics of Ossian's poetry are tenderness and sublimity. Ossian is, perhaps, the only poet who never relaxes, or lets himself down into the light and amusing strain. He moves perpetually in the high region of the grand and pathetic. The events which he records are all serious and grave; the scenery wild and romantic. We find not in him an imagination that sports itself, and dresses out gay trifles to please the fancy. His poetry, more perhaps than that of any other, deserves to be styled the *poetry of the heart*. It is a heart penetrated with noble sentiments, with sublime and tender passions; a heart that glows and kindles the fancy; a heart that is full, and pours itself forth. Of all the great poets, Homer is the one whose manner and whose times come the nearest to Ossian's Homer's ideas were more enlarged, and his characters more diversified, Ossian's ideas fewer, but of the kind fittest for poetry; the bravery and generosity of heroes, the tenderness of lovers, and the attachment of friends. Homer is diffuse; Ossian abrupt and concise. His images are a blaze of lightning, which flash and vanish. Homer has more of impetuosity and fire; Ossian of a solemn and awful grandeur. In the pathetic, Homer has a great power; but Ossian exerts that power much oftener, and has the character of tenderness more deeply imprinted on his works. No poet knew better how to seize and melt the heart. With regard to dignity of sentiment, we must be surprised to find that the pre-eminence must clearly be given to the Celtic bard. This appears nowhere more remarkable than in the sentiments which he expresses towards his enemies. "Uthal fell beneath my sword, and the sons of Berrathon fled.—It was then I saw him in his beauty, and the tear hung in my eye. Thou art fallen, young tree, I said, with all thy beauty round thee. Thou art fallen on thy plains, and the field is bare. The winds come from the desert, and there is no sound in thy leaves! Lovely art thou in death, son of car-borne Larthmore *." His supposition, that all the little feuds and differences of this life should be forgotten in a future state, and that those who had once been foes would "stretch their arms to the same shell in Loda," gives us the highest idea of the man as well as of the poet. "Daughter of beauty, thou art low! A strange shore receives thy corse. But the ghosts of Morven will open their halls when they see thee coming. Heroes around the feast of dim shells, in the midst of clouds shall admire thee; and virgins shall touch the harp of mist †."——"The feuds of other years by the mighty dead are forgotten. The warriors now meet in peace, and ride together on the tempest's wing. No clang of the shield, no noise of the spear, is heard in their peaceful dwellings. Side by side they sit, who once mixed in battle their steel. There, Lochlin and Morven meet at the mutual feast, and listen together to the song of their bards ‡."

* *Ossian's Works*, poem of *Berrathon*.

† *Gaelic Antiquities*, poem of *Trathal*.

‡ *Ib.* poem of *Dargo*.

But the sublimity of moral sentiments, if they wanted the softening of the tender, would be in hazard of giving a stiff air to poetry. It is not enough that we admire. Admiration is a cold feeling in comparison of that deep interest the heart takes in tender and pathetic scenes. With scenes of this kind Ossian abounds;

and

and his high merit in these is incontestable. He may be blamed for drawing tears too often from our eyes; but that he has the power of commanding them, no man who has the least sensibility can question. His poems awake the tenderest sympathies, and inspire the most generous emotions. No reader can rise from him without being warmed by the sentiments of humanity, virtue, and honour.

But the excellency of these poems occasioned in many persons a doubt of their authenticity. Their genuineness, however, has been very ably defended by Dr Blair and Lord Kames, and warmly supported by the author of the *Gaelic Antiquities*, who has given the public some more remains of Ossian's poetry.

As the nature of our work will not allow us to treat this matter at full length, we shall only give a brief view of the arguments offered in support of the authenticity of these poems, referring our readers to the authors just now mentioned and others, for fuller satisfaction.

"In every period of society (says Dr Blair), human manners are a curious spectacle; and the most natural pictures of ancient manners are exhibited in the ancient poems of nations. These make us acquainted with the notions and feelings of our fellow-creatures in the most artless ages; discovering what objects they admired, and what pleasures they pursued, before those refinements of society had taken place, which enlarge indeed, and diversify the transactions, but disguise the manners of mankind.

"Besides this, ancient poems have another merit with persons of taste. They promise some of the highest beauties of poetical writing. That state, in which human nature shoots wild and free, though unfit for other improvements, certainly encourages the high exertions of fancy and passion.

"In the infancy of societies the passions of men have nothing to restrain them; their imagination has nothing to check it. And as their feelings are strong, so their language of itself assumes a poetical turn. Men never have used so many figures of style, as in those rude ages, when, besides a warm imagination to suggest lively images, the want of proper and precise terms for the ideas they would express, obliged them to have recourse to circumlocution, metaphor, comparison, and all those substituted forms of expression, which give a poetical air to language. An American chief, at this day, harangues at the head of his tribe in a more bold metaphorical style than a modern European would venture to use in an epic poem.

"Poetry has been said to be more ancient than prose, which, in a qualified sense, is true. Music or song has been found coeval with society among the most barbarous nations; and the only subjects which could prompt men, in their first rude state, to utter their thoughts in compositions of any length, were such as naturally assumed the tone of poetry; praises of their gods, or of their ancestors; commemorations of their own warlike exploits; or lamentations over their misfortunes. And before writing was invented, no other compositions, except songs or poems, could take such hold of the imagination and memory, as to be preserved by oral tradition, and handed down from one race to another.

"Hence we may expect to find poems among the antiquities of all nations. It is probable, too, that an extensive search would discover a certain degree of resemblance among all the most ancient poetical productions, from whatever country they have proceeded. In a similar state of manners, similar objects and passions operating upon the imaginations of men, will stamp their productions with the same general character. Some diversity will, no doubt, be occasioned by climate and genius. But mankind never bear such resembling features as they do in the beginnings of society. What we call the *oriental vein* of poetry, because the earliest poetical productions have come to us from the east, is probably no more *oriental* than *occidental*; it is characteristical of an age rather than a country; and belongs, in some measure, to all nations at a certain period. Of this the works of Ossian seem to furnish a remarkable proof.

"He appears clearly to have lived in a period which enjoyed all the benefit I have just now mentioned of traditionary poetry. The exploits of Trathal, Trenmor, and the other ancestors of Fingal, are spoken of as familiarly known. Ancient bards are frequently alluded to. In one remarkable passage, Ossian describes himself as living in a sort of classical age, enlightened by the memorials of former times, conveyed in the songs of bards, and points at a period of ignorance which lay beyond the reach of tradition. Ossian himself appears to have been endowed by nature with exquisite sensibility; prone to that tender melancholy which is so often an attendant on great genius; and susceptible equally of strong and of soft emotions. He was not only a professed bard, but a warrior also, and the son of the most renowned hero and prince of his age. This formed a conjunction of circumstances, uncommonly favourable towards exalting the imagination of a poet.

"The manners of Ossian's age were favourable to a poetical genius. Covetousness and effeminacy were unknown. The cares of men were few. The great object pursued by heroic spirits, was, 'to receive their fame,' that is, to become worthy of being celebrated in the songs of bards; and 'to have their names on the four gray stones.' To die unlamented by a bard was deemed so great a misfortune as even to disturb their ghosts in another state. In such times as these, in a country where poetry had been so long cultivated, and so highly honoured, is it any wonder that, among the race and succession of bards, one Homer should arise: a man who, endowed with a natural, happy genius, favoured by peculiar advantages of birth and condition, and meeting, in the course of his life, with a variety of incidents proper to fire his imagination, and to touch his heart, should attain a degree of eminence in poetry, worthy to draw the admiration of more refined ages?"

Besides, his compositions, when viewed in themselves, have, we are told, all the internal marks of antiquity so strongly impressed upon them, that no reader of taste and judgment can deny their claim to it. They exhibit so lively a picture of customs which have disappeared for ages, as could be drawn only from nature and real life. The features are so distinct, that few portraits of the life continually passing before us are found to be drawn with so much likeness. The manners uniformly relate to a very early stage of society; and no hint, no allusion to the arts, customs, or manners, of a more advanced

vanced period, appears throughout the poems. To that distinction of ranks, which is always found in adult societies, the poet appears to have been a perfect stranger. The first heroes prepare their own repasts, and indiscriminately condescend to the most menial services. Their quarrels arise from causes generally slight, but in such a period extremely natural. A rivalship in love, an omission at a feast, or an affront at a tournament, are often the foundation of a quarrel among single heroes. And the wars in which whole tribes are engaged, are carried on with a view, not to enlarge their territory, but to revenge perhaps the killing of a few deer on their mountains, or the taking forcibly away one of their women. Their occupation was war and hunting; and their chief ambition was to have their fame in the songs of the bards.

The notions of a future state, exhibited in these poems, are likewise strongly marked with the character of antiquity. A creed so uncommon, that the imagination of a modern could not be supposed to grasp so strong an idea of it from mere fancy, is uniformly supported throughout. This creed is extremely simple, but admirably suited to the times.

The language, too, and the structure, of these poems, bear the most striking characters of antiquity. The language is bold, animated, and metaphorical, such as it is found to be in all infant states; where the words, as well as the ideas and objects, must be few; and where the language, like the imagination, is strong and undisciplined. No abstract, and few general, terms appear in the poems of Ossian. If objects are but introduced in a simile, they are always particularized. It is "the young pine of Inishuna:" it is "the bow of the showery Lena." This character, so conspicuous in the poems of Ossian, is a striking feature in the language of all early states; whose objects and ideas are few and particular, and whose ordinary conversation is of course highly figurative and poetical. A picture, therefore, marked with such striking features, could not be drawn without an original.

The whole texture of the composition is also, like the language, bold, nervous, and concise; yet always plain and artless; without any thing of that modern refinement, or elaborate decoration, which attend the advancement of literature. No foreign ornaments are hunted after. The wild and grand nature which lay within the poet's view, is the only source from which he draws his ornaments. Beyond this circle, his imagination, though quick and rapid, seldom made any excursion. We perceive his language always to be that of a person who saw and felt what he describes; who bore a part in the expeditions which he celebrates, and who fought in the battles which he sings. Such is the nature of the internal proof adduced in the present case, which unquestionably has weight, and that not inconsiderable; but unsupported by external proof, or contrary to facts, however forcible it may be in itself, when considered in this connection, and found wanting, it will neither silence the querulous sceptic, nor, in all probability, will it ever convince those who have truth for their object, and who wish to investigate, and, if possible, discover it on surer grounds. Internal proof is of the greatest service in a variety of excellent causes; but it comes in rather as a succedaneum than as direct evidence; and without something more to the purpose, it may excite admiration, but will seldom enforce belief. Of the customs and manners of ancient times we know but little, and of that little we have often but a confused notion. There is therefore room for genius and ability to exert itself in deceiving; and in proportion to the darkness in which the subject is involved, the deception will generally be the more complete, and the secret windings of error less easy to be developed.

Destitute of external proof, authenticity may appear to be probable, but cannot be certain; and in such circumstances, on many occasions, and especially with respect to ancient writings, we may, without any offence to truth or to sound reasoning, give them up as spurious. In the present instance, therefore, it is just and proper to add to what has been already said, the more external and positive proofs of the authenticity of the poems in question, by the strength or weakness of which the subject must be finally determined. It is observed, therefore, That there have been in the Highlands of Scotland, for some ages back, a vast many poems ascribed to Ossian: That these poems have been held in the highest veneration, repeated by almost all persons, and on all occasions. These are facts so well known, that nobody as yet has been hardy enough to deny them. There is not an old man in the Highlands, who will not declare, that he heard such poems repeated by his father and grandfather as pieces of the most remote antiquity. There is not a district in the Highlands where there are not many places, waters, isles, caves, and mountains, which from time immemorial are called after the names of Ossian's heroes.—There is not a lover of ancient tale or poetry, however illiterate, who is not well acquainted with almost every single name, character, and incident, mentioned in those translations of Ossian's poems, which he may have never heard of.—Bards, who are themselves several centuries old, quote those poems, imitate them, and refer to them.—The ordinary conversation and comparisons of the Highlanders frequently allude to the customs and characters mentioned in them;—and many of their most common proverbs, established by the most ancient use, are lines borrowed from the poems of Ossian *.—The most ancient of the clans boast of deriving their pedigree, each from some one of Ossian's heroes;—and many of the signs armorial assumed by them, are drawn from the feats ascribed to their predecessors in those poems †. Manuscripts are mentioned, in which some of those have been preserved for several centuries ‡; and a list of living names, in different part of the Highlands, is appealed to, as persons who still repeat a part of these poems ‖. Whilst Mr Macpherson was engaged in the translation, many respectable persons, gentlemen and clergymen, avowed to the public, that these were Ossian's poems, with which they had long been acquainted, and that the translation was literal §. This appears also from the large specimens of the originals published and compared by proper judges. The originals lay a considerable time in the hands of the bookseller, for the inspection of the curious; they have been afterwards shown frequently to many of the best judges, and offered for publication if the editor had been favoured with subscriptions. The editor of the pamphlet, in which their authenticity is attested by many respectable names of undoubted veracity, observes, by way of conclusion, "that more testimonies might have been produced by a more enlarged correspondence

* See examples under each of these heads in the Gaelic *Antiquities*, p. 93, 94, 95.

† *Ibid.* p. 164. in note.

‡ *Kames's Sketches*, book i.

‖ *Gaelic Antiquities*, p. 93, 125.

§ See list of names, *Appendix* to Dr Blair's Dissertation, *Ossian's Works*, 2d edit.

Ossian.

correspondence with the Highland counties: But I apprehend, if any apology is necessary, it is for producing so many names in a question where the consenting silence of a whole country was, to every unprejudiced person, the strongest proof that spurious compositions, in the name of that country, had not been obtruded upon the world." It is likewise argued in support of the authenticity of these poems, that candid sceptics, on hearing some of them repeated by illiterate persons, who had never seen the translation, caused them to give the meaning of what they repeated, by an extempore translation into English, and by this means had all their doubts of the authenticity of Ossian removed *. They urge further, that such passages of Ossian's works as are still repeated by some old men, are among the most beautiful parts of Ossian's poems; such as the battle of Lora, the most affecting parts of Carthon, Berrathon, the death of Oscar, and Darthula, or the children of Usnoth, &c.; which gives a credibility to his being equal to the other parts of the collection, none of it being superior to these in merit.

* Pref. to Dr Percy's *Reliques of Old English Poetry.* 1st edit.

To these and the like arguments advanced in support of the authenticity of the poems ascribed to Ossian, many objections have been urged. Those of Johnson and his friend Shaw are universally known. A later writer objects to them in the following manner: No fragments of British poetry in Scotland are to be found. Many specimens of Irish poetry in Scotland have been published; but none older than a century or two. Translations have also appeared; but, in general, of no fidelity. Those of the poems ascribed to Ossian in particular, have deservedly drawn much of the public attention; but they will only mislead any reader who wishes to form an idea of Celtic poetry. He that believes Ossian to have flourished about the year 300, and his writings preserved by oral tradition for 1460 years, large is his faith, and he might move mountains! Gentlemen of the Highlands of Scotland, with whom our author conversed on the subject, assured him, that they looked upon nine-tenths of Mr Macpherson's work as his own; and upon the other tenth, as so much changed by him, that all might be regarded as his own composition. There are positive evidences, he says, which convince him that not one of the poems given to Ossian, and probably not one passage of them is older than the 15th century. The very first author we know who mentions Fingal, is Barbour, a Scotch poet, who wrote in 1375. Fingal was an Irish hero: and one Good, a schoolmaster of Limerick, sent some account of Ireland to Camden, in 1566, in which mention is made of some strange fables, that the people amuse themselves with, about the "giants *Fin Mac Huyle*, and *Other Mac Oshin*," of which we shall speak more largely presently. In the mean time, to these and such like objections, it has been answered, That poetry has been cultivated with most success in the earliest ages of society; that in Greece, Orpheus, Linus, Hesiod, and Homer, wrote their admirable poems some ages before any thing had been written in prose in the Greek language; that the book of Job, written in a very early period of society, is highly poetical; that among the tribes of Lapland and America, there have been found, in the earliest state, some excellent pieces of poetry. That the Caledonians, in particular, had some peculiar institutions, which tended to improve their poetry: their druids were among the most learned philosophers which perhaps any age or country produced; their bards or poets were the disciples of those druids, and were always a standing order, to which none but the most promising geniuses were admitted. This standing college of poets was furnished, not only with the fruits of their own long study and observation, but also with as much as merited to be preserved of the compositions of their predecessors in office, since the "light of the song" first dawned. They had the advantage of one another's conversation; which would excite their emulation, and make them aspire to eminence: They were always present, and generally engaged, in every grand operation that was transacted; which could not fail to inspire their muse with the truest poetic fire.

Pinkerton.

The case of Ossian was particularly favourable. He lived in an age when manners came to a considerable degree of refinement under the care of the bards and druids. Poetry in his day was considerably advanced; and the language, though strong and figurative, had undergone some degree of cultivation, and learned to flow in regular numbers, adapted to the harp, the favourite instrument of the times. As a prince and a warrior, his mind must have been expanded and much enlarged by his excursions to other countries. At home he had Ullin, Alpin, Carril, and Ryno, to converse with; all of them poets of eminence, who would have advanced him greatly by their example and conversation. All these advantages, meeting with a native fire and enthusiasm of genius, as in the case of Ossian, may well be supposed to have produced poems that might challenge the veneration of ages.

But it is not to their merit alone that we owe the preservation of these poems so long by oral tradition. Other circumstances concurred; of which, the institution of the Bards deserves particular notice. In a country, the only one perhaps in the world in which there was always, from the earliest period almost to the present age, a standing order of poets, we cannot reasonably be surprised, either at finding excellent poems composed, or, after being composed, carefully preserved from oblivion. A great part of the business of this order was to watch over the poems of Ossian. In every family of distinction there was always one principal bard, and a number of disciples, who vied with each other in having these poems in the greatest perfection. Should the institution of the bards last for ever, the poems of Ossian could never perish.

Nor were they only the bards of great families who took an interest in these poems; the vassal, equally fond of the song with his superior, entertained himself in the same manner. This, with a life free from care, a spirit unbroken by labour, and a space of time unoccupied by any other employment or diversion, contributed to render the Highlanders a nation of singers and poets. From such a people, the superior merit of Ossian's poems would naturally procure every encouragement, which they always retained as long as the manners of the people remained unchanged.

Many other reasons conspired to preserve the poems of Ossian. The martial and intrepid spirit which they breathed, made it the interest of the chieftains to preserve them: the strain of justice, generosity, and humanity, which runs through them, recommended them to the superintendants of religion, who well knew how

Ossian. much the morals of a people must be tinctured with those songs which they are continually repeating, and which have all the advantages of poetry and of music. In superstitious ages, the people revered these poems, from their being addressed generally to some "son of the rock," supposed to be the tutelar saint of the place, or the great Irish apostle St Patrick. Besides, every hill and dale which the natives of the Highlands walked over, was classic ground. Every mountain, rock, and river, was immortalized in the song. This song would naturally be suggested by the sight of these objects, and everybody would hum it as he walked along. All the proverbs and customs to which these poems gave rise, would operate in the same manner. The son would ask what they meant, and the father would repeat the song from which they were taken. The distinct and unsubdued state in which the Highlanders remained for so long a course of ages, every clan, one generation after another, inhabiting the same valley, till towards the present century, contributed much to preserve their traditions and their poems; and the constant and general custom of repeating these in the winter nights, kept them always alive in their remembrance.

To these causes and customs the preservation of Ossian's poems, for so many ages, has been ascribed. But these causes and customs have ceased to exist; and the poems of Ossian, of course, have ceased to be repeated.—Within a century back, the Highlands of Scotland have undergone a greater revolution than it had done for ten before that period. With a quicker pace the feudal system vanished; property fluctuated; new laws and new customs stept in, and supplanted the old: and all this, with such sudden and such violent convulsions, as may well account for the shaking of a fabric which had stood so many ages, that it seemed to have bidden defiance to all the injuries of time. Even since Mr Macpherson gathered the poems in his collection, the amusements, employments, and taste of the Highlanders are much altered. A greater attention to commerce, agriculture, and pasturage, has quite engrossed that partial attention which was paid, even then, to the song of the bard. In twenty years hence, if manners continue to change so fast as they do at present, the faintest traces will scarce be found of those tales and poems. "Ossian himself is the last of his race; and he too shall soon be no more, for his gray branches are already strewed on all the winds."

Among the causes which make these poems vanish so rapidly, poverty and the iron rod should come in for a large share. From the baneful shade of those *murderers of the muse*, the light of the song must fast retire. No other reason needs be given why the present Highlanders neglect so much the songs of their fathers.—Once, the humble, but happy vassal, sat at his ease, at the foot of his grey rock or green tree. Few were his wants, and fewer still his cares; for he beheld his herds, sporting around him, on his then unmeasured mountain. He hummed the careless song, and tuned his harp with joy, while his soul in silence blessed his children.—Now, we were going to draw the comparison:

————sed Cynthius aurem
Vellit et admonuit.

It is more agreeable to remark, as another cause for the neglect of ancient poems and traditions, the growth of industry, which fills up all the blanks of time to more advantage, and especially the increase of more useful knowledge.—But above all, the extinction of the order of the bards hastened the catastrophe of Ossian's poems. By a happy coincidence Macpherson overtook the last that remained of this order, (Macvaurich, bard to Clanronald), and got his treasure. This fact (with the *red book* furnished by Mr Macdonald of Croidart, and some other MSS.) accounts for Mr Macpherson's having found these poems in greater number and perfection, than they could ever since be met with. The fragments, however, which have since been gathered, give a credibility to every thing that has been said of the original grandeur of the building.

Although this disquisition has already extended to a length which readers not partial to Scottish antiquities will perhaps think too great, we cannot dismiss it without observing, that Fingal and Ossian have been claimed by the Irish as well as by the Caledonians. On this double claim, as well as on the controversy concerning the authenticity of the poems, there is so much candour and good sense in the following remarks of T. F. Hill, published in the 53d volume of the Gentleman's Magazine, that we cannot deny ourselves the pleasure of making them conclude the article.

Mr Hill travelled through the Highlands of Scotland during the summer months of 1780. He seems to have been very ardent in his inquiries concerning Ossian, and to have conducted those inquiries with great judgment. The consequence was, that he received different accounts in different places, and picked up various songs relating to Fingal and his heroes.

"From this collection, it is evident (says he) that there are many traditional songs preserved in the Highlands relating to Fingal and his heroes, as well as to several other subjects. It is also evident, that these songs contain portions of the very poems published by Mr Macpherson and Mr Smith, under the name of *Ossian*. We may therefore justly conclude, that these poems are not wholly the forgery of their editors, but compiled at least from original songs. I by no means think it worth my while to notice the various concessions in favour of this conclusion, which the minor antagonists of Ossian have of late been forced to make. I myself have given proofs of it, which need I hope no external confirmation. To these proofs might be added, that I met with many traditional preservers of these songs, in every different part of the Highlands: some of whom, especially in Argyleshire, Lochaber, and on the rest of the western coast, were said to possess various poems attributed to Ossian, although I had neither leisure nor opportunity to collect copies from them.—But enough has already been said on this subject, if my testimony deserves regard.

"These principles being established, it remains to be considered how far the poems published by Macpherson and Smith deserve to be considered as the works of Ossian.

"The songs attributed to that bard, which contain passages of the Ossian of Macpherson and Smith, are by no means uniformly consistent with the poems in which the

the parallel passages are found, but frequently relate to different events, and even contain different circumstances. From hence it seems most probable, that Mr Macpherson and Mr Smith compiled their publications from those parts of the Highland songs which they most approved, combining them into such forms as according to their ideas were most excellent, and preserving the old names and the leading events. In this process they were supported and encouraged by the variety of songs preserved in the Highlands upon the same subject, and by the various modes in which the same event is related. Mr Macpherson may indeed have MSS. of all the poems he has published; which MSS. may either have been compiled by himself, or by some former collector; or they may possibly contain entire poems really ancient. But Mr Smith has honestly acknowledged, that he himself compiled his Ossian in the manner above described. 'After the materials were collected (says he), the next labour was to compare the different editions; to strike off several parts that were manifestly spurious; to bring together some episodes that appeared to have a relation to one another, though repeated separately; and restore to their proper places some incidents that seemed to have run from one poem to another:—and hence it was unavoidably necessary to throw in sometimes a few lines or sentences to join some of the episodes together.—I am sensible that the form of these poems is considerably altered from what is found in any one of the editions from which they are compiled. They have assumed somewhat more of the appearance of regularity and art —than that bold and irregular manner in which they are originally delivered.'

"Mr Smith also speaks of the Ossian of Mr Macpherson in a somewhat similar manner: 'That we have not the whole of the poems of Ossian, or even of the collection translated by Mr Macpherson, we allow: yet still we have many of them, and of almost all a part. The building is not entire, but we have still the grand ruins of it.'

"What portion, therefore, of the Ossian of Macpherson and Smith is original, no man can determine except themselves. Smith indeed says, that he has mentioned all his *material* alterations, transpositions, and additions, in his notes; and that, *for the most part*, he was guided in them by the Sgeulachds, or traditionary tales accompanying the songs; but there are few such notes in his book, and perhaps as few *such* Sgeulachds in the mouths of the Highlanders. In Macpherson and Smith also we see these poems divested of their idiomatic peculiarities and fabulous ornaments; which renders it impossible to discover what manners and opinions are really ancient, and what are of modern invention. Yet it is remarkable, that in spite of all the objections to their authenticity, necessarily produced by such a treatment of them, they still possess an internal evidence of originality which has enabled them hitherto to withstand all the torrent of opposition.

"The Ossian of Macpherson and Smith appears therefore to be a mutilated work, even though we should suppose that the songs they originally compiled from were the undoubted works of that celebrated bard. But this is far from being the case; for even allowing that an Ossian ever existed and wrote, yet time must have introduced such material changes in his works if preserved merely by tradition during so long a period, that their own author would hardly know them again. I think it however doubtful, whether such a being as Ossian ever appeared in the world.

"All the songs which I met with in the Highlands relative to the Feinne or Fingalians were attributed to Ossian: his name seems merely a common title, which is ascribed to all the poetic annals of his race.

"From these considerations, we seem authorized finally to conclude, that the Ossian of Macpherson and Smith is a mutilated compilation from Highland songs, ascribed indeed to that bard, yet very little likely to be his composition. Out of these they selected the best parts, and rejected such as they thought might discredit the character of Highland antiquity; attributing them to later times, and the ignorant bards of the fifteenth century. Perhaps even the works of Homer himself, which had so many different editions, very considerably varying from each other, were compiled by a somewhat similar process from the ancient Greek songs.

"Another question remains to be considered: Whether these songs are the compositions of the Highlands or of Ireland; and, whether Ossian was an Irish or a Caledonian Scot? It is my opinion, that the songs in this collection evidently manifest a connection with Ireland, though their traditional preservation in Scotland has sometimes introduced the name of Scotland in its stead. One of their principal personages is St Patrick, the peculiar apostle of Ireland, which alone seems sufficient to mark their origin (A). If therefore we may reason from a part to the whole, it is just to conclude, that all the other songs preserved in the Highlands relative to the Fingalians are also Irish. They are wholly confined to the western coast of the Highlands, opposite Ireland; and the very traditions of the country themselves acknowledge the Fingalians to be originally Irish. The genealogy of Fingal was there given me as follows: Fion Mac Coul, Mac Trathal, Mac Arsht Riogh Erin, or king of Ireland; thus attributing the origin of his race to the Irish. I am inclined to believe that these notions about Fingal were common to the Scots in the most ancient times, and brought by them from Ireland to Scotland, the hereditary superstition of both races; for, notwithstanding it may appear most probable that Ireland should receive colonies from Scotland than the contrary, we have direct historic evidences that Scotland received them from Ireland; and no bare theoretic probability deserves to be opposed to the positive assertions of history.

"With regard to the Erse manuscripts, about which so much has been said, it becomes me to acknowledge, that

(A) "The Scots indeed lay claim to the birth of St Patrick, and boast also his burial-place. Camden, edit. Gibson, 1695, pp. 921, 1014. And so also do the Britons, ib. p. 631, 1014; but his life and miracles all agree to attribute it to Ireland. In Gough's edition of Camden, the account of St Patrick is in vol. iii. p. 612, 618. See PATRICK, *St*.

that I have never seen enough of them to give any decided opinion: those which I have seen induced me to think they principally owe their existence to Ireland.

"I shall not repeat what others have said to prove the Fingalians Irish; though the connection of Fingal with Ireland has been already warmly asserted.

"But an unnoticed though curious, passage in Camden affords us the most remarkable, and perhaps the most convincing proof that Fingal is an Irish hero, which demonstrates at least that he was indisputably claimed by the Irish 200 years ago. It is contained in an extract (already mentioned) made by Camden, from an account of the manners of the native Irish, written by one Good, a schoolmaster at Limerick, in 1566. 'They think,' says he, speaking of Ireland and its inhabitants, 'the souls of the deceased are in communion with famous men of those places, of whom they retain many stories and sonnets; as of the giants Fin-Mac-Huyle, Oskir-Mac-Oschin, or Oschin-Mac-Owim; and they say, through illusion, that they often see them.'

"The very material importance of this curious passage, with relation to the present subject, it is unnecessary to urge; for every eye must see it. We also obtain from it new information in respect to the last part of the history of Fingal and his heroes; as it enables us to determine who they were with a precision which must otherwise have been wanting, to complete these remarks on the Highlands songs.

"The singular agreement of this passage with the accounts of Ossian which were taught me in Scotland is worthy particular remark; it confirms them even in the most novel and peculiar instances. The Fingalians were generally represented as giants: but the most remarkable occurrence is in the mythologic character attributed by both to Fingal, Oscar, and Ossian. In proof of this, I have to observe, that Mac Nab described Fingal as the Odin of the Scots, and that a song called *Urnigh Ossian* evidently speaks of him as such. This curious passage represents him exactly in the same character; a hero with whom the spirits of the deceased are in communion, who is their chieftain, and the lord of their feasts. The gods of all the northern nations seem to have been of this class; mighty heroes, esteemed once to have been invincible on earth, though perhaps not ever strictly men, nor yet constantly regarded as giants. Such are Odin, Thor, and the other Teutonic gods; such are Fingal, Oscar, and the rest of the Fingalians among the ancient Scots; such are Hercules, Bacchus, and even Jupiter himself, with all his sons and daughters, among the original Greeks, a people who agreed in many particulars with our own ancestors in northern Europe. The notions entertained about ghosts, as an intermediate order of beings between men and divinities, endowed with some share of power to do evil, is also remarkably congruous with this mythology.

"As Fingal was a divine hero, so Ossian seems to have been a divine bard. Some of the gods of the Teutons were bards in like manner; the god Niord and his wife Skada quarrelled in elegant verse of their own composition; and Odin is the relator of his own Edda. Apollo, the poetic deity of Greece, likewise sung the history of his fellow-deities to men on earth, as well as Orpheus his son. The bards and traditional preservers of songs in Scotland and Ireland have ever been fond of ascribing all ancient poems to this Ossian, and especially those relating to his own race; and from this cause the poems ascribed to Ossian are become so voluminous. The ancient Egyptians had a similar custom of ascribing their works to Hermes: οἱ ἡμέτεροι προγονοι τα αὑτων της σοφιας ευρηματα αυτῳ ανετιθεσαν Ἑρμου παντα τα οικεια συγγραμματα επονομαζοντες, says Jamblichus, S. I. c. 1. which rendered the Hermetic writings equally voluminous. The Egyptians, who possessed the art of writing, deposited their works in the adyta of their temples; as the Arabians deposited their poems of old in the temple of Mecca: but because the Egyptians affixed to them no author's name, except that of Hermes, to him, as to the Scottish Ossian, almost all the national literature was attributed by religious flattery.

"I sincerely wish, that some gentleman possessed of adequate abilities and acquaintance with the Erse language, would undertake to collect these Ossianic songs in their simple original state; as they undoubtedly contain much curious knowledge, accumulated in the various ages through which they have descended to us, and would probably afford much new information on subjects at present very ill understood. I own, however, that I should rather choose to seek for them in Ireland than in Scotland; but neither country should be unexplored.

"After having thus freely, though I hope not uncandidly, delivered my sentiments on the Ossian of Mr Macpherson, it becomes me to acknowledge myself deeply indebted to it for the pleasure in perusal it has frequently afforded me. I am willing, and indeed happy, thus publicly to declare myself a warm admirer of it as a literary composition. The novelty of its manner, of its ideas, and of the objects it describes, added to the strength and brilliancy of genius which frequently appears in it, have enabled me to read it with more delight, and to return to it more frequently, than almost any other work of modern times. And let it be regarded in what light it may, the praise of elegant selection and composition certainly belongs to its editor. If I had not entertained these opinions of its merit, I should never have taken so much pains to investigate its authenticity; nor indeed can I believe, if the general opinion had not concurred with mine, that the world would ever have wasted so much time in disputing about it."

Since what has now been said concerning the authenticity of the poems of Ossian was written, the same subject has been again brought under discussion, and more keenly and ably agitated than at any former period of the controversy. Among those who have entered the lists in this controversy, Mr Laing the historian appears by far the most powerful opponent of the authenticity of these celebrated poems. In a historical and critical dissertation* on this subject, Mr Laing roundly asserts, that the poems, as ascribed to Ossian, a bard of the third century, are forgeries, and charges Macpherson, as well as Smith (in our opinion too hastily and rashly), with direct fraud in imposing on the world their own productions as the genuine translations of ancient Gaelic poems. The arguments for the detection of these forgeries are arranged under eight different heads: 1. The Roman History of Britain with which Macpherson has connected the poems by false and incorrect allusions. 2. The traditionary poems in the Highlands refer to the middle ages,

* Hist. of Scotland.

ages, that is, about the 9th and 10th centuries. 3. The difficulty or impossibility of preserving poems by oral tradition for a period of 1500 years. 4. The remarkable diversity in the manners of the Highlanders at the period in which Fingal lived, as described by historians, and as they are represented by Ossian; and the contradiction of great refinement at an early age and extreme barbarism in a future age, are considered by Mr Laing as strong and decisive proofs of forgery. 5. From tracing the origin of the poems to other works of Macpherson, particularly to an epic poem entitled the Highlander, published at Edinburgh in 1758, which, being unsuccessful, appeared afterwards as fragments of ancient poetry, Mr Laing thinks another proof of detection is derived. 6. A sixth source of detection, in his opinion, may be traced to the imitation of the classics, scripture, and other writings. 7. Mr Laing asserts that the specimens of the original produced by Macpherson were either written or translated into Erse from the English original, by the supposed translator himself. 8. From the ambiguous language which Macpherson seems to have employed at different times during the progress of the numerous editions of the poems, Mr Laing infers a distinct avowal of fraud. But for the illustration of the arguments now noticed we must refer the reader to the dissertation itself.

It was not to be expected that charges so formally adduced, and so keenly supported, would pass altogether unnoticed by the admirers of the poems of Ossian, or the believers in their authenticity. Accordingly, we find that Mr Laing's arguments have been combated by different writers with various success. Among the works on this side of the question which have fallen in our way, the Essay on the Authenticity of the Poems of Ossian by the Rev. Dr Graham, holds the most respectable place. But our limits absolutely preclude us even from stating his arguments. We refer therefore to the work itself which, the reader will not dislike to find, is written with some degree of elegance, and, what is not usual in controversy, with a great degree of temper and moderation. The reader who wishes to pursue this investigation, may consult also a Treatise on the same subject by Mr Macdonald, the Report on Ossian by a Committee of the Highland Society of Scotland; and the Gaelic scholar has now an opportunity of perusing the Originals, which have been published by Sir John Sinclair.

OSSIFICATION, in the animal economy, the formation of the bones, but more particularly the conversion of parts naturally soft to the hardness and consistency of bones. Bones, Dr Drake contends, are formed out of the most comminute or broken parts of the blood; since we see that the blood of old men, which by a long course of circulation becomes in a manner unfit for the common office of nutrition, will however ossify, and convert into bones, many of the tendons and ligaments, and even the coats of the vessels themselves, whose substance being next to the bones the most compact, admits only of the smallest particles of the blood, which therefore soonest become osseous, as they are frequently found. Dr Nisbet's opinion of ossification is, that in the blood, or a fluid secreted from it, there is an ossifying juice, having particles which are not apparent: that whenever nature designs an ossification between membranes, or within a cartilage, she occasions a more than usual afflux of this fluid; which so much distends the vessels which were before invisible, as to make them capable of receiving the red globules of blood, which is always to be seen near to the place where ossification is begun. In this blood gritty bony particles may be felt by the point of a knife, which have been formed by the attraction and cohesion of the particles of the ossifying juice obstructed, along with the other grosser fluids, in the beginning of the vessels prepared to receive refluent juices. The blood being capable of forming fine membranes, the membranous parts of a bone, which acts as a gluten to keep these particles and fibres together, if there be any such, that do not arise from the coats of its vessels, are produced by a cohesion round the cretaceous particles of a part of the fluid, in which they were generated and contained. Thus the membranes of cartilages serve as a bed, between or within which the bony particles are deposited, or shoot; but without any intermixture of the particles of the bone and cartilage, or continuation of the fibres of the one substance to those of the other, as is evident in cartilages containing bones kept long enough in water, and then slit; for the bone will, as soon as the large vessels that enter its substance are divided, slip as easily, and perhaps easier, from it than an acorn does out of its cup: and there is a smoothness and polish of the parts of both cartilage and bone, which show there is no conjunction of the fibres of the two substances. While the bones are increasing within cartilages, the cartilages are extended and spread out; by which, with the pressure which they suffer, and the great influx of various fluids, and the nutritious matter being hindered to flow freely into them, they decrease continually, and at last may truly be said to be entirely destroyed. Dr Buddeus endeavours to prove, that the preternatural ossifications, which are commonly said to be formed in different parts of the body, do not deserve that name; for that these hard substances have scarcely any other properties of bone except whiteness and hardness.

OSSORY, the west division of Queen's-county in Ireland.

OSSORY, *Bale, bishop of*. See BALE.

OSSUNA, an ancient and considerable town of Andalusia in Spain, with an university, an hospital, and the title of a duchy. N. Lat. 37. 8. W. Long. 4. 18.

OSTADE, ADRIAN VAN, an eminent Dutch painter, born at Lubec in 1610. He was a disciple of Francis Hals, in whose school Brouwer was cotemporary with him, where they contracted an intimate friendship. The subjects of his pencil were always of a low kind, he having nearly the same ideas as Teniers; diverting himself with clowns and drunkards in stables, ale-houses, and kitchens. His pictures are so transparent and highly finished, that they have the polish and lustre of enamel: they have frequently a force superior to Teniers; yet it were to be wished that he had not designed his figures so short. He is perhaps one of the Dutch masters who best understood the *chiaro obscuro*; and he was often employed to paint figures for the best landscape painters of his countrymen. He died in 1685. His works, especially those of his best time and manner, are very scarce; so that when they are to be purchased, no price is thought too much for them. His prints etched by himself, large and small, consist of 54 pieces.

OSTALRIC, a town of Catalonia, in Spain, having a strong castle, and seated on the river Tordera, in E. Long. 2. 45. N. Lat. 24. 44.

OSTEND,

Ostend, Osteocolla.

OSTEND, a very strong sea-port town of the Netherlands, with a good harbour and a magnificent town-house, and containing 10,288 inhabitants in 1800. It is not very large, but it is well fortified. It was much more considerable before the long siege of the Spaniards, which continued from 1601 to 1604, when it was almost entirely reduced to ashes. The Dutch lost 50,000 men, and the Spaniards 80,000. Isabella Eugenia, governante of the Netherlands, made a vow she would not shift her smock before Ostend surrendered; but before the town was taken it had greatly changed its colour. However, the ladies of the court, to keep her in countenance, had theirs dyed, that they might be like that of their mistress. This place was taken by the Dutch in 1706, but restored to the emperor in 1724, when an East India company was established here, but entirely suppressed by treaty in 1731. It was taken by the French in August 1745, after 10 days siege, but restored by the treaty of Aix-la-Chapelle. It was taken again by the French republicans, under Dumourier, but was quickly recovered by the allies. The French repossessed it in 1794. Here the British landed a body of troops in May 1798, who blew up and destroyed the works of the Bruges canal; but the wind shifting before they could re-embark, they were under the necessity of surrendering to the French. In 1814 it separated from France with the Netherlands. It is 10 miles W. of Bruges, eight N. E. of Newport, 22 N. E. of Dunkirk, and 60 N. W. of Brussels. E. Long. 2. 56. N. Lat. 51. 14.

OSTEOCOLLA, οστεοκολλα, in *Natural History*, a white or ash-coloured sparry substance, in shape like a bone, and by some supposed to have the quality of uniting broken bones, on which account it is ordered in some plasters; a supposition, we fear, which is not warranted by experience. It is found in long, thick, and irregularly cylindric pieces, which are in general hollow, but are sometimes filled up with a marly earth, and sometimes contain within them the remains of a stick, round which the osteocolla had been formed; but though it is plain from thence that many pieces of osteocolla have been formed by incrustations round sticks, yet the greater number are not so, but are irregularly tubular, and appear to be formed of a flat cake, rolled up in a cylindric shape. The crusts of which these are composed do not form regular concentric circles round the internal cavity, as must have been the case had they been formed by incrustation. On the other hand, they plainly show that they were once so many thin strata, composing a flat surface, which has afterwards been rolled up, as one might do a paper three or four times doubled, into two, three, or more spiral lines; in which case, each single edge of the paper would be everywhere a regular point of a continued spiral line drawn from a given point; but they would by no means be so many detached concentric circles. The osteocolla is found of different sizes, from that of a crow-quill to the thickness of a man's arm. It is composed of sand and earth, which may be separated by washing the powdered osteocolla with water, and is found both in digging and in several brooks, in many parts of Germany, and elsewhere. It is called hammosteus in many parts of Germany. It has this name in these places from its always growing in sand, never in clay, or any solid soil, nor even in gravel. Where a piece of it any where appears on the surface, they dig down for it, and find the branches run ten or twelve feet deep. They usually run straight down, but sometimes they are found spreading into many parts near the surface, as if it were a subterraneous tree, whose main stem began at 12 feet depth, and thence grew up in a branched manner till met by the open air. The main trunk is usually as thick as a man's leg, and the branches that grow out from it are thickest near the trunk, and thinner as they separate from it. The thinnest are about the size of a man's finger. The people employed to collect it, when they cannot find any mark of it on the surface, search after the specks of white or little lumps of whitish soft matter, which they find lying in various parts on the top of the sand. These always lead them either to a bed of perfect osteocolla, or to some in the formation. If they miss of it, they still find a substance like rotten wood; which when traced in its course, is found to proceed from a main trunk, at the depth of that of the osteocolla, and to spread itself into branches in the same manner. The diggers call this substance the flower of osteocolla, or hammosteus.

Osteocolla || Ostervald.

The osteocolla found in the earth is at first soft and ductile, but in half an hour's time, if exposed to the air, it becomes as hard as we find it in the shops. The method to take up a perfect piece for a specimen is to open the ground, clear away the sand, and leave it so for an hour or thereabouts: in this time it will harden, and may be taken out whole. It is certain, that the osteocolla is produced at this time; for if a pit be cleared of it, there will more grow there in a year or two, only it will be softer, and will not harden so easily in the air as the other. What the rotten substance resembling the decayed branches of trees is, we cannot determine, unless it really be such; but the opinion of the common people, that it is the root of something, is absurd, because its thickest part always lies at the greatest depth, and the branches all run upwards. The osteocolla is a marly spar, which concretes round this matter; but what it is that determines it to concrete no where on the same ground but about these branches, it is difficult to say. The rottenness of this substance, which forms the basis of the osteocolla, renders it very liable to moulder and fall away; and hence it is that we usually see the osteocolla hollow. Sometimes it is found solid; but in this case there will be found to have been a vegetable matter serving as its basis, and instead of one branch, it will be found in this case to have concreted about a number of fibres, the remains of which will be found in it on a close examination. See Phil. Trans. N° 39.

OSTEOLOGY, that part of anatomy which treats of the bones. See ANATOMY, Part I.

OSTERVALD, JOHN FREDERIC, a famous Protestant divine, was born at Neufchattel in 1663; and made such rapid progress in his studies, that he became master of arts at Samur before he was 16 years of age. He afterwards studied at Orleans and at Paris. At his return to Neufchattel in 1699, he became pastor of the church there; and contracted a strict friendship with the celebrated John Alphonsus Turretin of Geneva, and the illustrious Samuel Werenfels of Basil. The union of these three divines, which was called the *Triumvirate of the divines of Swisserland*, lasted till his death. Mr Ostervald acquired the highest reputation, by his virtues, his zeal in instructing his disciples, and restored ecclesiastical

siastical discipline. He wrote many books in French; the principal of which are, 1. A Treatise concerning the Sources of Corruption, which is a good moral piece. 2. A Catechism, or Instruction in the Christian Religion; which has been translated into German, Dutch, and English; and the Abridgement of the Sacred History, which he prefixed to it, was translated and printed in Arabic, in order to be sent to the East Indies, by the care of the Society for the Propagation of the Gospel; and that Society established in London, paid him a high compliment, by admitting him an honorary member. 3. A treatise against impurity. 4. An edition of the French Bible of Geneva, with Arguments and Reflections, in folio. 5. *Ethica Christiana*. 6. *Theologiæ Compendium*, &c. He died in 1747, regretted by all who knew him.

OSTIA, a town situated at the mouth of the Tiber, about 12 miles to the westward of Rome. It was built by Ancus Martius, the fourth king of Rome, and was called *Ostia Tiberina*, in the plural number, *i. e.* the two mouths of the Tiber, which were separated by the Holy Island, an equilateral triangle, whose sides were each of them computed at about two miles. The colony of Ostia was founded immediately beyond the left or southern, and the port immediately beyond the right or northern branch of the river; and the distance between their remains measures something more than two miles on Cingolani's map. In the time of Strabo, the sand and mud deposited by the Tiber had choked the harbour of Ostia; the progress of the same cause has added much to the size of the Holy Island, and gradually left both Ostia and the port at a considerable distance from the shore. The dry channels (*fiumi morti*), and the large estuaries (*stagno di Ponente, de Levante*), mark the changes of the river, and the efforts of the sea. Its port was one of the most stupendous works of Roman magnificence, and it was a long time one of the best towns on the coast; but having been destroyed by the Saracens, and the harbour choked up, as mentioned above, it has not been able since to recover itself. Though it be an inconsiderable place, and but poorly inhabited by reason of the badness of the air, yet it is the see of a bishop, who is always deacon of the cardinals, and crowns the Pope. The old Ostia, where are seen the ruins of the ancient harbour, is beyond New Ostia, towards the sea; the latter is but a little cluster of houses, with a small castle. It is 12 miles S. W. of Rome. E. Long. 12. 24. N. Lat. 41. 44. There were saltworks in Ostia, called *Salina Ostiensis*, as early as the times of Ancus Martius (Livy); from which the *Via Salaria*, which led to the Sabines, took its name, (Varro). It gave name to one of the gates of Rome, which was called *Ostiensis* (Ammian).

OSTIACKS, a people of Siberia in Asia. They live upon the banks of the rivers Oby and Yeuisey, and on those of some other rivers which fall into these. These people are very poor, and very lazy, and in the summer time live mostly upon fish. They are of a middle size, with broad faces and noses, and yellowish or red hair. All their garments from top to toe are made of fish skins, for they have neither linen nor woollen: and indeed they might almost as well go naked. Their greatest diversion is hunting; and they go together in crowds, with a weapon like a large knife fastened in a stick. In summer they take and dry the fish which serves them in winter; and when that season begins, they go into the woods with their bows and arrows, their dogs and nets, to kill sables, ermines, bears, reindeer, elks, martens, and foxes. Part of the furs of these is paid as a tax to the empress of Russia, and the rest are sold at a stated price to the Russian governors, but sometimes they are allowed to dispose of them to private persons.

They chiefly live upon venison, wild fowl, fish, and roots, for they have neither rice nor bread. They drink for the most part water, and it is said they can very well relish a draught of train oil. They are immoderately fond of tobacco, and of swallowing the smoke, which soon intoxicates them. In the winter they build their huts in woods and forests, where they find the greatest plenty of game, and dig deep in the earth to secure themselves from the cold, laying a roof of bark or rushes over their huts, which are soon covered with snow. In summer they build above ground on the banks of the rivers, to enjoy the convenience of fishing, and make no difficulty of forsaking their habitations. They have a sort of princes among them, in one of whose houses some European travellers found four wives (A). One of these had a red cloth coat on, and was set off with all sorts of glass beads. There was no other furniture than cradles and chests, made of the bark of trees sewed together. Their beds consisted of wood shavings, almost as soft feathers, and their children lie naked upon them in cradles. They can neither read nor write, nor do they cultivate the land; and seem totally ignorant of times past. They have neither temples nor priests; and their boats are only made of the bark of trees sewed together. Their religion is Pagan; and they have some little brazen idols, tolerably well cast, representing men and animals, made of wood and earth, all of which are dressed in silks in the manner of Russian ladies. In general, however, they are ill made, every man being his own carver. They place them on the tops of hills, in groves, and in the pleasantest places their country affords, and sometimes before their huts; yet they have no set time for performing religious worship, but apply to their gods for success in all their undertakings. As they have no regular priests, every old man may devote himself to that service, and the office is frequently performed by the masters and heads of families. Strahlenberg says, that when he was among them he saw one of their temples, which was built of wood in an oblong form, like a great barn, covered at the

(A) They may have as many wives as they please, and make no scruple of marrying their nearest relations. They purchase a wife of her relations for three or four rein-deer, and take as many as they please, returning them again if they do not like them, only losing what they gave for the purchase. Upon the birth of their children, some give them the name of the first creature they happen to see afterward. Thus the child has frequently the name of an animal, and you hear a man call his son perhaps *Sabatski*, or my little dog; others call their children according to the order of their birth, as *First*, *Second*, *Third*, &c.

the top with birch bark. At the end of the wall supporting the gable was a kind of altar, made of timber, on which were placed two idols, representing a man and woman, dressed in all sorts of rags; and round these were other small figures, as deer, foxes, and hares, all which were roughly carved in wood, and also clothed in rags. They did not appear to have much devotion, nor any great reverence for their idols. When they offer sacrifices, they present the beast to the idol; and having bound it, an old man puts up the petitions of those who brought the offering; he then lets fly an arrow at the beast, and the people assist in killing it. It is then drawn three times round the idol; and the blood being received into a vessel, they sprinkle it on their houses; they afterwards dress the flesh and eat it, rejoicing and singing their country songs: they also besmear the idol with the blood of the sacrifice, and grease their mouths with the fat. What they cannot eat they carry home to their families, and make presents of it to their neighbours: they as often sacrifice a fish as a beast. At the conclusion of the feast they shout, to show their gratitude to the idol for his attending and accepting their devotions; for they are persuaded that the saint or hero represented by the image always attends their sacrifices, which when over he returns to his abode in the air. There is nothing more surprising, nor, if properly improved, is there any thing more instructing, than the history of superstition. It is with this view that we have given so enlarged a view of the Ostiacks, longer, some may imagine, than their importance demands. It would, however, in our opinion, be improper to let such an opportunity slip of exhibiting the extreme weakness of unassisted reason, and the consequent necessity of a divine revelation. That the religion of these ignorant and misguided Pagans is the corruption of a primitive revelation, we think at least probable; nor do we see any way of so satisfactorily accounting for the universal use of sacrifices. The Ostiacks are obliged to take an oath of fidelity to the Russian government; and on these occasions they use the following ceremony. After laying down a bear skin and an axe, and holding over it a piece of bread and a knife, they say, "In case I do not to my life's end prove true and faithful to the supreme government of the country, or if I knowingly and willingly break through my allegiance, or be wanting in the duty I owe to the said supreme government, may the bear tear me to pieces in the wood; may the bread I eat stick in my throat and choke me; may the knife stab me, and the axe cut off my head." The like ceremony is used among them in the deposition of a witness.

OSTRACION, a genus of fishes belonging to the order *Cartilaginei*. See Ichthyology, p. 103.

OSTRACISM, in Grecian antiquity, denotes the banishment of such persons whose merit and influence gave umbrage to the people of Athens, lest they should attempt any thing against the public liberty. This punishment was called *ostracism*, from the Greek word ὀστρακον, which properly signifies a "shell;" but when applied to this object, it is used for the billet on which the Athenians wrote the names of the citizens whom they intended to banish. The learned are divided with regard to the substance of which this billet was formed: some insist that it was a small stone, or a piece of brick; some that it was a piece of bark; and others assert, that it was a shell. The word admits most of these interpretations. But what determines its true sense, is the epithet given it by ancient authors, of *ceramitè mastix;* which words signify, "The punishment of potter's clay;" and this expression seems to us a proof, that the word ὀστρακον, when applied on this occasion, signifies a "piece of baked earth, in the form of a shell;" and undoubtedly the Latin authors had this idea of the word here, for they translated it by *testula*.

The ancients are likewise divided with regard to the time when ostracism was instituted. But they all agree, that the person who moved the law was its first victim. But as to the name of its patron, and the time of its establishment, they differ extremely. Many are of opinion, that ostracism owes its origin to very remote times.

However that be, the punishment of ostracism was inflicted by the Athenians when their liberty was in danger. If, for instance, jealousy or ambition had sowed discord among the chiefs of the republic; and if different parties were formed, which threatened some revolution in the state; the people assembled to propose measures proper to be taken in order to prevent the consequences of a division which in the end might be fatal to freedom. Ostracism was the remedy to which they usually had recourse on these occasions; and the consultations of the people generally terminated with a decree, in which a day was fixed for a particular assembly, when they were to proceed to the sentence of ostracism. Then they who were threatened with banishment, omitted no assiduity or art which might gain them the favour of the people. They made harangues to evince their innocence, and the great injustice that would be done them if they were banished. They solicited, in person, the interest of every citizen; all their party exerted themselves in their behalf: they procured informers to vilify the chiefs of the opposite faction. Some time before the meeting of the assembly, a wooden inclosure was raised in the forum, with ten doors, i. e. with as many as there were tribes in the republic; and when the appointed day was come, the citizens of each tribe entered at their respective door, and threw into the middle of the inclosure the small brick on which the citizen's name was written whose banishment they voted. The archons and the senate presided at this assembly, and counted the billets. He who was condemned by 6000 of his fellow citizens, was obliged to quit the city within ten days; for 6000 voices, at least, were requisite to banish an Athenian by the ostracism.

The Athenians, without doubt, foresaw the inconveniences to which this law was subject; but they chose rather, as Cornelius Nepos hath remarked, sometimes to expose the innocent to an unjust censure, than to live in continual alarms. Yet as they were sensible that the injustice of confounding virtue and vice would have been too flagrant, they softened, as much as they could, the rigour of ostracism. It was not aggravated with the circumstances which were most dishonourable and shocking in the ordinary mode of exile. They did not confiscate the goods of those who were banished by ostracism. They enjoyed the produce of their effects in the places into which they were banished; and they were banished only for a certain time. But in the common banishment, the goods of the exiles were always confiscated, and no hopes were given them of ever returning to Athens.

The scholiast of Aristophanes informs us of a third difference betwixt ostracism and the common banishment. He says, that a particular place of retirement was assigned to those who were banished by ostracism, which was not appointed to the other exiles. We suspect, however, the truth of this observation; for Themistocles was certainly not limited in his banishment. That great man, as we are told by Thucydides, though his chief residence was at Argi, travelled over all the Peloponnesus.

This punishment, far from conveying the idea of infamy, became, at Athens, a proof of merit, by the objects on which it was inflicted; as Aristides the sophist justly observes, in his second declamation against the Gorgias of Plato, where he says, that ostracism was not an effect of the vindictive spirit of the people against those whom it condemned; that the law, whether good or bad, (for he enters not into an examination of the question), was only meant to prune the luxuriant growth of transcendent merit: that it condemned to an exile of ten years, only those illustrious men who were accused of being exalted far above other citizens by their conspicuous virtue; and that none of that public indignation was shown to the exiles by ostracism, which commonly breaks out against criminals.

Such were the mitigations with which this law was introduced among the Athenians: and by them we see that they were sensible of all the inconveniences to which it was subject. They were indeed too enlightened a people, not to foresee the many instances of injustice which it might produce; that if in some respects it would be favourable to liberty, in others it would be its enemy, by condemning citizens without allowing them a previous defence, and by making a capricious and envious people arbiters of the fate of great men; that it might even become pernicious to the state, by depriving it of its best subjects, and by rendering the administration of public affairs an odious employment to men of capital talents and virtue.

However great the inconveniences of ostracism were, it would not have been impossible to avoid them; and we may add, that this law would have been of service to the state, if the people by whom it was instituted had always had discernment enough only to give it force on such occasions as endangered liberty. But its fate was like that of almost all other laws which the wisest legislators have planned for the good of communities. Destined by their institution to maintain order, to repress injustice, and to protect innocence, men have found ways to pervert their application, and have made them instruments to gratify their private passions. Thus ostracism was established to prevent the dangerous enterprises of the great, and to preserve the vigour of the democracy; but the people of Athens, naturally jealous and envious, exerted that law, to remove men of eminent merit from the state, by whose presence they were reproved and intimidated. The fear of tyranny was commonly but a specious pretext with which they veiled their malignity. The repeated victories which they had gained over the Persians, had rendered them, says Plutarch, proud and insolent. Intoxicated with their prosperity, they arrogated all its glory to themselves; they were jealous of those citizens whose political and military talents were the subjects of public eulogium. They thought the glory acquired by great men diminished their own reputation. An Athenian no sooner distinguished himself by a splendid action, than he was marked out as a victim by public envy. His reputation was a sufficient reason for his banishment.

OSTRACITES, in *Natural History*, a name used for the fossil oysters, common in many parts of England. They are of various shapes and kinds; and the name is by some authors made to signify the shell itself, when preserved in its native state and condition; as is the case with those about Woolwich and Blackheath; and by others, the stones cast or formed in those shells, or in cavities from whence they have been washed away.

OSTREA, the OYSTER, a genus of shell-fish belonging to the order of vermes testacea. See OSTREA, CONCHOLOGY *Index*.

OSTRICH. See STRUTHIO, ORNITHOLOGY *Index*.

OSTROVIZZA, in Dalmatia (see DALMATIA), supposed by some to be the Arauzona, and by others the Stlupi of the ancients, though probably it has no connection with either the one or the other. It was purchased in 1410 by the republic of Venice, for 5000 ducats, and some pieces of land besides. Its fortress, which was seated on a rock, perpendicularly cut all round, and deservedly reckoned impregnable before the use of artillery, was taken by Soliman in 1524, but soon after restored to the dominion of Venice. At present, no traces of its fortification remain, and it is only a bare and isolated mass. It now belongs to Austria.

OSTUNI, a town of Italy, in the kingdom of Naples, and in the Terra di Otranto, with a bishop's see. Its territory is well cultivated, and abounds with olives and almonds. It is seated on a mountain near the gulf of Venice, in E. Long. 17. 49. N. Lat. 49. 59.

OSWEGO, a fort of North America, seated on the east side of a river of the same name, and on the south side of the lake Ontario, in W. Long. 76 30. N. Lat. 43. 15.

OSWEIZEN, a town of Austrian Poland, in the palatinate of Cracovia, formerly having the title of a duchy. It carries on a great trade in salt, and is seated on the river Vistula. E. Long. 19 47. N. Lat. 50. 1.

OSWESTRY, an old town of Shropshire, in England, 172 miles from London, with a castle, a wall, and a ditch, and was anciently a borough. It is a place celebrated in Saxon history and legendary piety. On this spot, August 5. 642, was fought the battle between the Christian Oswald, king of the Northumbrians, and the pagan Penda, king of the Mercians, in which Oswald was defeated, and lost his life. The barbarian victor cut the body of the slain prince in pieces, and stuck them on stakes dispersed over the field as so many trophies; but, according to others, his head and hands only were thus exposed. A prince so dear to the church as Oswald, and so attached to the professors of the monastic life, received every posthumous honour they could bestow. He was raised to the rank of a saint, and his sanctity confirmed by numberless miracles, which are too numerous and too trifling to admit of particular description. Its church, which is of no great antiquity, was formerly a monastery, and was called Blancminster. It is, however, spacious, and has a handsome plain tower. In 1542 and 1567, it suffered much by fire. It is governed by two bailiffs, burgesses, &c. and once had a great trade in Welch cottons and flannels; but this is

Oswestry, Osymandes.

now much decayed. Its population in 1801 was 2672, and in 1811 it was 3479. But besides a good grammar school, it is noted for an excellent charity-school for 40 boys, besides girls, which has the best methods for exciting the emulation of the children in their learning; for 20 of the boys are set to strive against 20 others for shoes, and the 20 who perform their task best have shoes first; then 10 of the boys are set against 10 others for the like premium, and so on till they are all shod: so in the girls school a shift is put up for the best spinner, a head-dress for the best sempstress, a pair of stockings for the best knitter, a Bible for the best reader, and a copy-book for the best writer. In the wall with which the town was fortified there were four gates. That called the *Block-gate* is demolished; the New-gate, Willow-gate, and the Beatrice-gate, still remain. The last is a handsome building, with a guard-room on both sides. There are only two fragments of the castle remaining. It stood on an artificial mount, surrounded by a fosse, extending to the Willow-gate.

OSYMANDES, a famous king of Egypt, was, according to some authors, the first monarch who collected a great number of books for the purpose of forming a library. To this curious collection he gave the title of *Pharmacy of the Soul*. Of all the monuments of the kings of Thebes, that of Osymandes is one of the most magnificent. "He appears (says an elegant author) to have been a prince of great elegance and taste in his day. Diodorus Siculus describes many sumptuous edifices erected by him; among those edifices his palace or mausoleum, whichsoever it was, has been eminently distinguished for the paintings and sculptures with which it was adorned. When we look to the subject of those works, we shall have reason to think that no man in any age could discover a fairer and more enlightened judgment than he did in the employment of the genius around him, which was not tamely devoted to dull or contracted objects, nor lavished on scenes of savage life, nor wholly engrossed in allusions to himself, but sensibly enlarged to a variety of contemplation which might become a great sovereign; and in each of those parts the subject was characteristically great.

Bromley's Hist. of the Fine Arts, vol. i.

"* In one place was represented, in a multitude of sculptures, his expedition against the Bactrians, a people of Asia, whom he had invaded with 400,000 foot, and 20,000 horse, and whom he conquered. In another part was displayed the variety of fruits and productions, with which Pan, the great source of all things, had enriched the fertile land over which Osymandes reigned. A third group of figures represented the monarch himself, as the high priest of the country, offering to the gods the gold and silver which he drew every year from the mines of Egypt. In another part of the edifice was exhibited, in an infinite number of figures, an assembly of judges, in the midst of a great audience attentive to their decisions; the president or chief of those judges, surrounded by many books, wore on his breast a picture of Truth with her eyes shut—these emphatic emblems, beyond which no age could go for the impression of that wisdom and impartiality which ought to prevail in administrative justice."

* *Diod. Sic.* lib. i. p. 45. edit. Rhodom.

In short, we cannot without astonishment read the account which Diodorus Siculus gives of the almost incredible magnificence of this prince, and of the immense sums which he spent upon those grand works. Amongst a variety of other surprising curiosities, was to be seen a statue in the attitude of sitting, which was the largest in all Egypt, the length of one of the feet being seven cubits. Not only the art of the sculptor, but also the beauty of the stone, which was perfect in its kind, contributed to render this a masterpiece of sculpture. It bore the following inscription: *I am OSYMANDES, king of kings; whoever will dispute with me this title, let him surpass me in any of my works.*

Osymandes ‖ Otaheite.

Indeed (to use the words of the same elegant author quoted above) "the palace or mausoleum of this accomplished prince must give us a striking assurance of the progress which had been made in the arts at that time; whether he lived, as some have thought * the immediate successor of the first Busiris, which was somewhat later than the period of Semiramis; or, as others have conceived †, subsequent to Sesostris, which would be 400 years later. Diodorus Siculus, who describes that edifice, says nothing of the age in which Osymandes lived; every opinion, therefore, on that point must be conjecture. We shall only remark, that there is nothing in the works of art in that edifice which should appear too much for the earliest age in which that monarch has been placed, when we look back to what was done of those works in a period full as early by Semiramis in Assyria."

* See *Rollin's Anc. Hist.*

† *Marsham*, p. 403. *Goguet*, vol. ii. p. 141.

OTACOUSTIC INSTRUMENT, or *Auricular Tube*, an instrument to facilitate the hearing. See ACOUSTICS.

OTAHEITE, a celebrated island of the South sea, situated in W. Long. 149. 13. S. Lat. 17. 46. It was discovered by Captain Wallis in 1767; afterwards Mr Bougainville touched here; and it was visited by Captain Cook in 1773 and 1774, who had in 1769 sailed round the island in a boat to observe the transit of Venus.

The island consists of two distinct kingdoms, which are united by a narrow neck of land; the larger being called by the natives *Tiarrabou*, or *O-Taheitee Nue*; the smaller one *Opoureonou*, or *O-Taheitee-Ete*. The circumference of both islands is about 40 leagues; the larger kingdom being divided into 43 districts. The country has a delightful romantic appearance. The coast, viewed from the sea, presents a most beautiful prospect, being elevated like an amphitheatre. The island is skirted with a reef of rocks, and towards the sea is level, being covered with fruit trees of various kinds, particularly the cocoa-nut. At the distance of about three miles from the shore, the country rises into lofty hills that are covered with wood, and terminate in peaks, from which large rivers are precipitated into the sea. The stones everywhere appear to have been burnt, not one being found which did not give manifest signs of fire; so that there is great reason for supposing that this and the neighbouring islands are either the shattered remains of a continent, or were torn from rocks, which from the creation of the world have been the bed of the sea, and thrown up in heaps to a height which the waters never reach. What is farther extraordinary, the water does not gradually grow shallow as we approach the shore, but is of immense depth close by the land; and the islands in this neighbourhood are almost everywhere surrounded by reefs which appear to be rude and broken in the manner that some violent concussion would naturally leave the solid substance of the

1 Appearance of the country.

Otaheite. the earth; and Mr Foster saw a rock with projecting longitudinal angles of black compact basaltes. The exterior ranges of hills are sometimes entirely barren, and contain a great quantity of yellowish clay, mixed with iron ochre; but others are covered with mould and wood like the mountains in the internal parts of the country. Pieces of quartz are sometimes met with here; but no indications of precious minerals or metals of any kind have been observed, iron only excepted.

2 Climate. The air is extremely healthy and pleasant; the heat is not troublesome; and fresh meat will keep very well for two days, and fish one day. The winds do not blow constantly from the east, but generally a little breeze from east to south-south-east. The tide rises very little; and, being governed by the winds, is very uncertain. "The climate," says M. Bougainville, "is so healthy, that notwithstanding the hard labour of the ships companies while on shore, though the men were continually in the water, and exposed to the meridian sun, though they slept upon the bare soil, and in the open air, none of them fell sick; those who were afflicted with the scurvy, and were sent on shore, regained their strength: although they were obliged to assist in the erecting of a fort, and had scarce one uninterrupted night, yet they were so far recovered in the short space of time they continued there, that they were afterwards perfectly cured on board."

3 High mountains. Notwithstanding the great height of the inland mountains of Otaheite, none of their rocks have the appearance of barrenness, every one of them being covered with woods. "We hardly believed our eyes," says M. de Bougainville, "when we saw a peak covered with woods up to its highest summit, which rises above the level of the mountains in the interior parts of the southern quarter of this island. Its apparent size seemed to be more than 30 toises in diameter, and grew less in breadth as it rose higher. At a distance it might have been taken for a pyramid of immense height, which the hand of an able sculptor had adorned with garlands and foliage." One of the mates of the Dolphin, with a party of marines and seamen, penetrated into the interior parts of the island; and having ascended, with great difficulty, a mountain which they supposed to be a mile high, they discovered mountains before them so much higher, that with respect to them they seemed to be in a valley: towards the sea the view was enchanting, the sides of the hills were beautifully clothed with wood, villages were everywhere interspersed, and the valleys between them afforded a still richer prospect; the houses stood thicker, and the verdure was more luxuriant; and Mr Foster, with other gentlemen, ascended to the summit of one of the highest mountains in the island, from whence they had a prospect of the island of Huahine, and some others lying at the distance of 40 leagues; from which we may form some judgment of the prodigious height of that mountain. The view of the fertile plain below them, and of a river making innumerable meanders, was delightful in the highest degree. The vegetation on the upper part of the mountains was luxuriant, and the woods consisted of many unknown sorts of trees and plants.

4 Soil and produce. The soil of this island is a rich fat earth, of a blackish colour. It produces spontaneously, or with the slightest culture imaginable, a great variety of the most excellent fruits; such as bread-fruit, cocoa nuts, bananas of 13 sorts, plantains, potatoes, yams, a fruit known here by the name of *jambu*, and reckoned most delicious; sugar-canes, which the inhabitants eat raw; ginger; turmeric; a root of the salep kind, called by the inhabitants *pea*; a plant called *ethee*, of which the root only is eaten; a fruit that grows in a pod like that of a large kidney bean, by the natives called *ahee*; a tree called *wharra*, which produces fruit something like the pine-apple, and which is known in the East Indies by the name of *pandanus*; a shrub called *nono*; the *morinda*, which also produces fruit; a species of fern; a plant called *theve*; and the Chinese paper-mulberry, of the bark of which they make their cloth; an herb which the inhabitants eat raw, its flavour somewhat resembling that of the West India spinage called *calletoon*, but its leaf very different; a plant which the natives call *ava* or *eava*, from the root of which they express a liquor, which, if drank to excess, intoxicates like wine or distilled spirits. Here are a sort of shady trees covered with a dark green foliage, bearing golden-coloured apples, which, in juiciness and flavour, resemble the ananas or pine-apple. One of the most beautiful trees in the world received here the name of *Barringtonia*; it had a great abundance of flowers larger than lilies, and perfectly white, excepting the tips of their numerous chives, which were of a deep crimson. Such a quantity of these flowers were seen dropped off, that the ground underneath the tree was entirely covered with them. The natives called the tree *buddov*; and said, that the fruit, which is a large nut, when bruised and mixed up with some shell-fish, and thrown into the sea, intoxicates the fish for some time, so that they come to the surface of the water, and suffer themselves to be taken with people's hands. Several other maritime plants in tropical climates are found to have the same quality. Mr Dalrymple describes the method of catching fish with these plants as follows: the plant is thrust under the coral rocks or hollows where the fish haunt; the effect is most sensible in still water, though it is effectual in the open sea; for the same gentleman says, he has seen fish soon after float on the surface of the water half dead, and some totally without life; and where the effect is less violent, the fish will be seen under the water to have lost their poise, without coming up to the surface. Fish caught in this manner are not in the least noxious or ill tasted.

In this island they have domestic poultry exactly resembling those of Europe: besides which there are wild ducks; also beautiful green turtle doves; large pigeons of a deep blue plumage and excellent taste; a small sort of paroquets, very singular on account of the various mixture of red and blue in their feathers; also another sort of a greenish colour, with a few red spots; the latter are frequently tamed, and are valued on account of their red feathers. Here is a kingfisher of a dark green, with a collar of the same hue round his white throat; a large cuckoo, and a blue heron. Small birds of various kinds dwell in the shady trees; and, contrary to the generally received opinion that birds in warm climates are not remarkable for their song, have a very agreeable note. There were no quadrupeds but dogs, hogs, and rats: and for these last the natives were said to have a scrupulous regard, insomuch that they would by no means kill them; however, 5 Animals.

Otaheite. however, Captain Cook, in 1773, turned about 14 cats on the island, which have probably reduced the number of these vermin. No frogs, toads, scorpions, centipedes, or any kind of serpent, have been found here; the ants, however, are troublesome, but not very numerous. When the Endeavour first arrived here in 1769, the flies were found excessively troublesome; but musqueto nets and fly-flaps in some measure removed the inconvenience. Sydney Parkinson, in his journal, says, that notwithstanding these flies are so great a nuisance, the natives, from a religious principle, will not kill them. But there is a strange disagreement in the accounts of different voyagers concerning this matter. For M. Bougainville says, "this island is not infested with those myriads of troublesome insects that are the plague of other tropical countries." And Mr Forster says, "not a gnat or musqueto hummed unpleasantly about us, or made us apprehensive of its bite." This inconvenience must therefore be felt at certain seasons of the year, and in certain districts of the country, more sensibly than at other times and places. There is great variety of excellent fish; and according to Aitourou, a native who embarked with M. de Bougainville, there are sea-snakes on the shore of Otaheite, whose bite is mortal.

6 Description of the inhabitants, &c. The inhabitants of Otaheite are a stout, well-made, active, and comely people. The stature of the men, in general, is from five feet seven to five feet ten inches; the tallest man seen by Captain Wallis measured six feet three inches and a half; and Captain Cook, in his second voyage, describes O-Too, the king of Otaheite, to be of that height. "In order to paint a Hercules or a Mars," says M. de Bougainville, "one could nowhere find such beautiful models." They are of a pale brown complexion; in general their hair is black, and finely frizzled; they have black eyes, flat noses, large mouths, and fine white teeth; the men wear their beards in many fashions, all of them plucking out a great part, and have prominent bellies. Most of them smell strong of the cocoa-nut oil. The women in general are much smaller, especially those of the lower rank or tawtows, which is attributed to their early and promiscuous intercourse with the men; whilst the better sort who do not gratify their passions in the same unbridled manner, are above the middle stature of Europeans. Their skin is most delicately smooth and soft: they have no colour in their cheeks; their nose is generally somewhat flat, but their eyes are full of expression, and their teeth beautifully even and white. "The women," says M. de Bougainville, "have features not less agreeable than the generality of Europeans, and a symmetry of body and beautiful proportion of limbs which might vie with any of them. The complexion of the men is tawney; but those who go upon the water are much more red than those who live on shore. Some have their hair brown, red, or flaxen, in which they are exceptions to all the natives of Asia, Africa, and America, who have their hair black universally; here, in the children of both sexes, it is generally flaxen. The strongest expression is painted in the countenances of these people; their walk is graceful, and all their motions are performed with great vigour and ease." "I never beheld statelier men, (says Sydney Parkinson). The men of consequence on the island wear the nails of their fingers long, which they consider as a very honourable badge of distinction, since only such people as have no occasion to work can suffer them to grow to that length. This custom they have in common with the Chinese; but the nail of the middle finger on the right hand is always kept short, the meaning for which peculiarity could not be learned. Only one single cripple was met with among them, and he appeared to have been maimed by a fall. The women always cut their hair short round their heads. Both sexes have a custom of staining their bodies, which they call *tattowing*; both men and women have the hinder part of their thighs and loins marked very thick with black lines in various forms; these marks are made by striking the teeth of an instrument somewhat like a comb just through the skin, and rubbing into the punctures a kind of paste made of soot and oil, which leaves an indelible stain. The boys and girls under twelve years of age are not marked; a few of the men, whose legs were marked in chequers by the same method, appeared to be persons of superior rank and authority. Mr Banks saw the operation of tattowing performed upon the backside of a girl about thirteen years old. The instrument used upon this occasion had thirty teeth; and every stroke, of which at least a hundred were made in a minute, drew an ichor or serum a little tinged with blood. The girl bore it with most stoical resolution for about a quarter of an hour; but the pain of so many hundred punctures as she had received in that time, then became intolerable. She first complained in murmurs, then wept, and at last burst into loud lamentations, earnestly imploring the operator to desist. He was, however, inexorable; and when she began to struggle, she was held down by two women, who sometimes soothed and sometimes chid her; and now and then, when she was most unruly, gave her a smart blow. Mr Banks staid in a neighbouring house an hour, and the operation was not over when he went away; yet it was performed but upon one side, the other having been done some time before; and the arches upon the loins, in which they most pride themselves, and which gave more pain than all the rest, were still to be done. Both men and women are not only decently but gracefully clothed, in a kind of white cloth that is made of the bark of a shrub, and very much resembles coarse China paper. Their dress consists of two pieces of this cloth; one of them, having a hole made in the middle to put the head through, hangs from the shoulders to the mid-leg before and behind; another piece, which is between four and five yards long, and about one yard broad, they wrap round the body in a very easy manner: This cloth is not woven; but is made like paper, of the macerated fibres of the inner bark spread out and beaten together. Their ornaments are feathers, flowers, pieces of shell, and pearls; the pearls are worn chiefly by the women. In wet weather they wear matting of different kinds, as their cloth will not bear wetting. The dress of the better sort of women consists of three or four pieces: one piece, about two yards wide and eleven long, they wrap several times round their waist, so as to hang down like a petticoat as low as the middle of the leg; and this they call *paroo*. This simple drapery affords the sex an opportunity of displaying an elegant figure to the greatest advantage, according to the talents and taste of the wearer: no general fashions force them to disfigure instead of adorning themselves, but an innate gracefulness is the companion of simplicity.

Otaheite. simplicity. To this cloth they give a very strong perfume.

7 Of their houses. The chief use which they make of their houses is to sleep in them; for unless it rains, they eat in the open air under the shade of a tree. These houses are no other than sheds, all built in the wood between the sea and the mountains; they are erected on an oblong square; their width is nearly half of their length; they are nothing more than a roof, not quite four feet from the ground, raised on three rows of pillars, one row on each side, and one in the middle. The roof resembles our thatched houses in England, and consists of two flat sides inclining to each other. Their thatch consists of palm-leaves. The floor of their dwelling is covered with hay, over which they spread mats. Some of these erections are furnished with a stool, which is appropriated solely to the use of the master of the family; they consist of no other furniture except a few blocks of wood, which being square, one side is hollowed into a curve; and these they use as pillows, and with their apparel they cover themselves. In these open dwellings the whole family repose themselves at night. The size of the house is proportioned to the number that constitutes the family. The established order in these dormitories is, for the master and his wife to sleep in the middle; round them the married people; in the next circle the unmarried women; and in the next, at the same distance, the unmarried men; and the servants at the extremity of the shed; but in fair weather the latter sleep in the open air. Some few dwellings, however, constructed for greater privacy, are entirely inclosed with walls of reeds, connected together with transverse pieces of wood, so as to appear somewhat like large bird cages closely lined; in these houses there is commonly a hole left for the entrance, which can be closed up with a board.

Their candles are made of the kernels of a kind of oily nut, which they stick one above another on a skewer that is thrust through the middle of them; the upper one being lighted burns to the second, at the same time consuming that part of the skewer that goes through it; the second taking fire burns in the same manner down to the third, and so to the last; they burn a considerable time, and afford a pretty good light. The natives generally retire to rest about an hour after it is dark.

8 Food, method of cookery. The food of the common people entirely consists of vegetables. These are, the bread-fruit, with bananas, plantains, yams, apples, and a sour fruit, which, though not pleasant by itself, gives an agreeable relish to roasted bread-fruit, with which it is frequently beaten up. The flesh, which is reserved for the tables of the great, is either poultry, hogs, or dogs; the flesh of their fowls is not well-tasted, but that of dogs is esteemed by the natives beyond pork. The smaller fish are generally eaten raw, as we eat oysters: every thing that can be procured from the sea is made an article of their food; for they will eat not only sea-insects, but what the seamen call *blubbers*, though some of them are so tough that they are obliged to suffer them to become putrid before they can be chewed. A very large shark being caught by the Dolphin's people was given to the natives; who soon cut it to pieces, and carried it away with great satisfaction.

They kill the animals they intend for food by suffocating them, which is done by stopping the mouth and nose with their hands; they then singe off the hair, by holding the animal over a fire, and scraping him with a shell: with this instrument they cut him up, and take out the entrails; which are washed, and put into cocoa-nut shells, together with the blood. Dogs are eaten that are fed wholly upon bread-fruit, cocoa-nuts, yams, and other vegetables, and are never suffered to taste any animal food; and those who have tasted the flesh of a dog thus fed, have declared it to be little inferior to English lamb. In order to dress their food, they kindle a fire, by rubbing the end of one piece of dry wood upon the side of another, in the same manner as a carpenter with us whets a chisel. They then dig a pit about half a foot deep, and two or three yards in circumference; they pave the bottom with large pebble stones, which they lay down very smooth and even, and then kindle a fire in it with dry wood, leaves, and the husks of cocoa-nuts. When the stones are sufficiently heated, they take out the embers, and rake up the ashes on every side; they then cover the stones with a layer of green cocoa-nut leaves, and wrap up the animal that is to be dressed in the leaves of the plantain. If it is a small hog, they wrap it up whole; if a large one, they split it. When it is placed in the pit, they cover it with the hot embers, and lay upon them bread-fruit and yams, which are also wrapped up in the leaves of plantain. Over these they spread the remainder of the embers, mixing among them some of the hot stones, with more cocoa-nut tree leaves upon them, and then close up all with earth, so that the heat is kept in; the oven is kept thus closed a longer or shorter time according to the size of the meat that is dressed. The meat, when taken out, is said to be better dressed than any other way. They use shells for knives; and carve very dexterously with them, always cutting from themselves. One of the principal attendants on Oberea, attempting the use of the knife and fork, could not feed himself therewith; but by the mere force of habit, his hand came to his mouth, and the victuals at the end of his fork went away to his ear.

They are quite unacquainted with the method of boiling water, as they have no vessels among them that will bear the fire. Whilst the noble Oberea was one morning at breakfast with Captain Wallis on board the Dolphin, the surgeon filled the tea-pot by turning the cock of a vase that stood upon the table. One of the lady's attendants observed this practice very attentively, and soon after turning the cock himself, received the water upon his hand; he no sooner felt himself scalded, than he roared and danced about in an extravagant manner. The other Indians, unapprised of the cause of these emotions, stood gazing at him in amazement, and not without some mixture of terror: but the gentlemen in company, who soon perceived the cause of the outcry, dispelled the apprehensions of their visitants; and some ointment being applied to the scald, good humour and confidence were again restored. The gunner of the ship, who was appointed comptroller of the market which was established on shore with the natives, used to dine on the spot; the astonishment of these people was very great to see him dress his pork and poultry in a pot; at length an old man, who was extremely serviceable in bringing down provisions to be exchanged, was put into possession of an iron pot, and from that time

Otaheite. time he and his friends ate boiled meat every day. Several iron pots were likewise given to Oberea and some of the chiefs: which were in constant use, and drew every body to see them; but although the particulars of two successive voyages of Captain Cook to this island are circumstantially related, we hear no more of this improvement in the culinary art, or of the further assistance which has been rendered those people in supplying them with pots for boiling; but however desirous the natives might be to eat boiled meat, it was not adviseable to have such an article for barter as iron kettles, when a few spike nails, or a common hatchet, would procure one of their largest hogs.

Salt water is the usual sauce to their food; those who live near the sea have it furnished as it is wanted, others at a distance keep it in large bamboos. The kernels of the cocoa-nuts furnish them with another sauce; these, made into a paste something of the consistence of butter, are beat up with salt water, which has a very strong flavour; but though at first it seemed very nauseous, yet when the taste became familiar, it was much relished.

Their general drink is water, or the milk of the cocoa-nut. They showed in general an aversion to strong liquors; and whenever any one of them happened to drink so freely with any of the ship's company as to be intoxicated, he resolutely refused to taste any thing that was likely to produce the same effect again; but they have a plant which they call *ava ava*, from the root of which they procure a liquor which has an inebriating quality. Their manner of preparing this strong drink is as simple as it is disgusting to an European. Several of the people take some of the root, and chew it till it is soft and pulpy; they then spit it out into a platter or other vessel, every one into the same: into this general receptacle water is poured according to the quantity prepared. The juice thus diluted is strained through some fibrous stuff like fine shavings, after which it is fit for drinking, and it is always prepared for present use: it has a pepperish taste; drinks flat, and rather insipid; and though it intoxicates, yet Captain Cook saw but one instance where it had that effect, as the natives generally drink it with great moderation, and but little at a time. Sometimes they chew this root as Europeans do tobacco, and sometimes they will eat it wholly.

They eat alone, or at least only in company with a guest that happens to call in; and the men and women never sit down together to a meal: the shade of a spreading tree serves them for a parlour; broad leaves spread in great abundance serve for a table-cloth; and if a person of rank, he is attended by a number of servants who seat themselves round him: before he begins his meal, he washes his mouth and hands very clean, and repeats this several times whilst he is eating. The quantity of food which these people eat at a meal is prodigious. Captain Cook says, he has seen one man devour two or three fishes as big as a perch; three bread-fruits, each bigger than two fists; 14 or 15 plantains, or bananas, each six or seven inches long and four or five round, and near a quart of the pounded bread-fruit. Men of rank are constantly fed by their women; and one of the chiefs who dined on board the ships in 1769, showed such reluctance to feed himself, that one of the servants was obliged to feed him to prevent his returning without his meal. In one of the excursions which the gentlemen of the ships made into the country in 1773, they arrived at a neat house, where a very fat man, who seemed to be a chief of the district, was lolling on his wooden pillow; before him two servants were preparing his dessert, by beating up with water some bread-fruit and bananas in a large wooden bowl, and mixing with it a quantity of fermented sour paste called *mahie*. While this was doing, a woman, who sat down near him, crammed down his throat by handfuls the remains of a large baked fish, and several bread-fruits, which he swallowed with a voracious appetite: his countenance was the picture of phlegmatic insensibility, and seemed to testify that all his thoughts centered in the gratification of his appetite. He scarce deigned to look at the strangers; and a few monosyllables which he uttered, were extorted from him to remind his feeders of their duty, when by gazing at them they grew less attentive to him.

That these people, who are remarkably fond of society, and particularly that of their women, should exclude its pleasures from the table, where, among all other nations, whether civil or savage, they have been principally enjoyed, is truly inexplicable. How a meal, which everywhere else brings families and friends together, comes to separate them here, was a singularity much inquired about, but never accounted for. "They ate alone (they said), because it was right;" but why it was right to eat alone, they never attempted to explain. Such, however, was the force of habit in this instance, as it is in every other, that they expressed the strongest dislike, and even disgust, at their visitants eating in society, especially with women, and of the same victuals. "At first (says Captain Cook) we thought this strange singularity arose from some superstitious opinion; but they constantly affirmed the contrary. We observed also some caprices in the custom, for which we could as little account as the custom itself. We could never prevail with any of the women to partake of the victuals at our table, when we were dining in company; yet they would go five or six together into the servants apartments, and there eat very heartily of whatever they could find: nor were they in the least disconcerted if we came in while they were doing it. When any of us have been alone with a woman, she has sometimes eaten in our company; but then she has expressed the greatest unwillingness that it should be known, and always extorted the strongest promises of secrecy. Among themselves, even two brothers and two sisters have each their separate baskets of provisions, and the apparatus of their meal. When they first visited us at our tents, each brought his basket with him; and when we sat down to table, they would go out, sit down upon the ground, at two or three yards distance from each other, and turning their faces different ways take their repast without exchanging a single word. The women not only abstain from eating with the men, and of the same victuals, but even have their victuals separately prepared by boys kept for that purpose, who deposit it in a separate shed, and attend them with it at their meals. But though they would not eat with us, or with each other, they have often asked us to eat with them, when we have visited those with whom we were particularly acquainted at their houses; and we have often upon such

such occasions eaten out of the same basket, and drank out of the same cup. The elder women, however, always appeared offended at this liberty; and if we happened to touch their victuals, or even the basket that contained it, they would throw it away."

After meals, and in the heat of the day, the middle-aged people of the better sort generally sleep. They are indeed extremely indolent; and sleeping and eating are almost all that they do. Those that are older are less drowsy, and the boys and girls are kept awake by the natural activity and sprightliness of their age.

9 Diseases.

These islanders, who inhabit huts exposed to all the winds, and hardly cover the earth, which serves them for a bed, with a layer of leaves, are remarkably healthy and vigorous, and live to an old age without enduring any of its infirmities; their senses are acute, and they retain their beautiful teeth to the last. M. de Bougainville describes an old man, whom they saw on their landing, who had no other character of old age, than that respectable one which is imprinted on a fine figure. His head was adorned with white hair, and a long white beard; all his body was nervous and fleshy; he had neither wrinkles, nor showed any other tokens of decrepitude. This venerable man seemed displeased at the arrival of these strangers; he even retired without making any returns to the courtesies they paid to him; but he gave no signs either of fear, astonishment, or curiosity: very far from taking any part in the raptures which the multitude expressed, his thoughtful and suspicious air seemed to indicate, that he feared the arrival of a new race of men would interrupt the happiness he had so long enjoyed. From whence it may be inferred, that his mind was not a whit more impaired than his body. There are, however, several sorts of leprous complaints on this island, which appear in cutaneous eruptions of the scaly kind; some were seen that had ulcers upon different parts of their bodies; yet they seemed little regarded by those who were afflicted with them, and no application whatever was used to them, not so much as to keep off the flies. But instances of them are rare, as the excellency of their climate, and the simplicity of their vegetable food, prevent almost all dangerous and deadly disorders. They are sometimes afflicted with the cholic, and coughs are not unknown among them; and the chiefs, who fare more sumptuously, as a punishment for their voluptuousness are sometimes attacked with a disorder similar to the gout, in which the legs are swelled and excessively painful. M. de Bougainville's surgeon assured him, that he had seen many with marks of the smallpox.

The usual method employed here to restore the sick to health, is by pronouncing a set form of words; after which the exorcist applies the leaves of the cocoa-tree plaited to the fingers and toes of the sick; so that nature is left to conflict with the disease, without being assisted with any salutary application of art. But though they seem utterly destitute of medical knowledge, they appear to be no inconsiderable proficients in surgery, which they had an opportunity of proving while the Dolphin lay here. One of the seamen, when on shore run a large splinter into his foot; and the surgeon not being at hand, one of his comrades endeavoured to take it out with a pen-knife: but after putting the poor fellow to a great deal of pain, he was obliged to give it over; an old native, who had been very active and successful in establishing a good understanding between the ship's company and his countrymen, happening to be present, called a man from the other side of the river, who having examined the lacerated foot, fetched a shell from the beach, which he broke to a point with his teeth; with which instrument he laid open the wound, and extracted the splinter. Whilst this operation was performing, the old man went a little way into the wood, and returned with some gum, which he applied to the wound upon a piece of the cloth that was wrapped round him, and in two days time it was perfectly healed. This gum was produced by the apple-tree; the surgeon of the ship procured some of it, and used it as a vulnerary balsam with great success. Captain Cook, in 1769, saw many of the natives with dreadful scars; one man, in particular, whose face was almost entirely destroyed; his nose, including bone, was perfectly flat; and one cheek and one eye were so beaten in, that the hollow would almost receive a man's fist; yet no one ulcer remained.

The venereal disease is said to have been entailed upon these people by the crew of M. de Bougainville's ships, who visited this island a short time after Captain Wallis had left it. In 1769, more than one-half of the crew in Captain Cook's ship had contracted it, during a month's stay here. The natives distinguished it by a name of the same import with rottenness, but of a more extensive signification. They described, in the most pathetic terms, the sufferings which the first victims to its rage endured; and told him that it caused the hair and the nails to fall off, and the flesh to rot from the bones; that it spread universal terror and consternation among the inhabitants, so that the sick were abandoned by their nearest relations, lest the calamity should spread by contagion, and were left to perish alone in such misery as till then had never been known among them. But there seems to be some reason to hope that they had found out a specific cure for it, as none were seen on whom it had made a great progress; and one who went from the ship infected, returned, after a short time, in perfect health. Both Captain Cook and Mr Forster, in their relations of their voyage in the Resolution, endeavour to establish the opinion that this scourge of licentiousness was felt in the South sea islands previous to any of the modern voyages that have been made thither, and that it was an indigenous disease there. But if that conclusion be well founded, how comes it, that at all the places where the Resolution touched in 1773, which had before been visited by the Endeavour in 1769, such as New Zealand, for instance, the crew, more or less, became infected by their commerce with the women, and not at all so at places which they visited, for the first time, in the Resolution?

10 Manufactures.

The principal manufacture among the Otaheiteans is their cloth. This is made of the bark of trees, which are of three kinds, viz. the Chinese mulberry-tree, or *aouta;* the bread-fruit tree, or *ooroo;* and one that is described by Dr Hawkesworth as resembling the wild-fig tree of the West Indies. Of all these the paper mulberry affords the best cloth; what is made from that being both finer, softer, whiter, and better suited to take a colour; the *ooroo* produces cloth much inferior in contexture; and the last is very coarse, in colour

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colour resembling the darkest brown paper; but this last is the only kind that withstands water: (See the article BARK).—They likewise prepare a red dye; which is made by mixing the yellow juice of a small species of fig, which the natives call *mattee*, with the greenish juice of a sort of fern or bindweed, or of several other plants, which produce a bright crimson: and this the women rub with their hands, if the piece is to be uniformly of a colour; or they make use of a bamboo reed if the piece is to be marked or sprinkled into different patterns. The colour fades very soon, and becomes of a dirty red; but notwithstanding this defect, and its being liable to be spoiled by rain, the cloth thus stained is highly valued, and is worn only by the principal inhabitants of the country. The inhabitants perfume their cloths with certain plants; concerning which, Mr Forster made all possible inquiry. Tahea, a friendly native, showed him several plants which are sometimes used as substitutes; but the most precious sort, he either could not, or would not, point out: and from the account of Omai it appears that there are no less than 14 different sorts of plants employed for this purpose.

Matting is another Otaheitean manufacture: and in this they are so dexterous, that they produce finer mats, than any made in Europe. Rushes, grass, the bark of trees, and the leaves of a plant called *wharrou*, are the materials which they work up for this purpose. Their matting is applied to various uses: the coarser kind is employed for sleeping on in the night, or sitting on through the day; the finer sort is converted into garments in rainy weather, their cloth being soon penetrated by wet. They are very dexterous in making basket and wicker-work: their baskets are of a vast number of different patterns, many of them exceedingly neat; and the making them is an art practised by every one, both men and women.

Instead of hemp, they make ropes and lines of the bark of a tree; and thus they are provided with fishing nets; the fibres of the cocoa-nut furnish them with thread, with which they fasten the different parts of their canoes, &c. The bark of a nettle which grows in the mountains, and is called *orawa*, supplies them with excellent fishing lines, capable of holding any kind of fish; and their hooks are made of mother-of-pearl, to which they fix a tuft of hair, made to resemble the tail of a fish. Instead of making them bearded, the point is turned inwards. They make also a kind of seine of a coarse broad grass, the blades of which are like flags. These they twist and tie together in a loose manner, till the net, which is about as wide as a large sack, is from 60 to 80 fathoms long. This they haul in smooth shoal water; and its own weight keeps it so close to the ground, that scarcely a single fish can escape. They make harpoons of cane, and point them with hard wood; with which they can strike fish more effectually than an European can with one headed with iron.

11
Working tools.

The tools used by the Otaheiteans for all their purposes are, an adze made of stone; a chisel or gouge made of bone, generally the bone of a man's arm between the wrist and elbow; a rasp of coral, and the skin of a sting-ray; also coral and sand, as a file or polisher: and with these they fell timber, cleave and polish it, and hew stone. The stone which makes the blade of their adzes is a kind of basaltes, of a gray or blackish colour, not very hard, but of considerable toughness; they are formed of different sizes; some that are intended for felling, weigh from six to eight pounds; others that are used for carving, not more than as many ounces: but it is necessary to sharpen these rude tools almost every minute; for which purpose a cocoa-nut shell full of water and a stone are always at hand. With such tools they generally take up several days in felling a tree; but after it is down, and split into planks, they smooth them very dexterously and expeditiously with their adzes, and can take off a thin coat from a whole plank without missing a stroke.

12
Weapons.

Their weapons are slings, which they use with great dexterity; pikes headed with the skins of sting-rays; and clubs of about six or seven feet long, made of a very hard wood. Thus armed, they are said to fight with great obstinacy; and to give no quarter to man, woman, or child, who happens to fall into their hands during the battle, nor for some time afterwards, till their passion subsides. They have likewise bows and arrows; but the arrows are good for nothing except to bring down a bird, being headed only with stone, and none of them pointed. They have targets of a semicircular form, made of wicker-work, and plaited strings of the cocoa-nut fibres, covered with glossy, bluish-green feathers belonging to a kind of pigeon, and ornamented with many shark's teeth, arranged in three concentric circles.

13
Canoes.

Their boats or canoes are of three different sorts. Some are made out of a single tree, and hold from two to six men. These are principally employed in fishing: the others are constructed of planks very dexterously sewed together; they are of different sizes, and will hold from 10 to 40 men: they generally lash two of these together, and set up two masts between them; or if they are single, they have an out-rigger on one side, and only one mast in the middle; and in these vessels they will sail far beyond the sight of land. The third sort seems to be principally designed for pleasure or shew. These are very large, but have no sail; and in shape resemble the gondolas of Venice. The middle is covered with a large awning; and some of the people sit upon it, and some under it. The plank of which these vessels are constructed, is made by splitting a tree, with the grain, into as many thin pieces as possible. The boards are brought to the thickness of about an inch, and are afterwards fitted to the boat with the same exactness that might be expected from an expert joiner. To fasten these planks together, holes are bored with a piece of bone, fixed into a stick for that purpose. Through these holes a kind of plaited cordage is passed, so as to hold the planks strongly together. The seams are caulked with dry rushes; and the whole outside of the vessel is painted over with a kind of gummy juice, which supplies the place of pitch.

14
Character, manners, &c.

The Otaheiteans are a very industrious people, and friendly in their dispositions; but like all other nations not fully civilized, their passions are extremely violent, and they are very fickle. The manner of singling out a man here for a chosen friend is by taking off a part of your clothing and putting it upon him. Their usual manner of expressing their respect to strangers, or their

4

Otaheite. their superiors, at a first meeting, is by uncovering themselves to the middle. They have a custom of saluting those who sneeze, by saying *evaroeia-eatoua*, "May the good eatoua awaken you," or "May not the evil eatoua lull you asleep!"

Their propensity to theft is very great, insomuch, that M. Bougainville says, "even in Europe itself one cannot see more expert filchers than the people of this country; and indeed, in all the voyages made by Captain Cook and others, they had abundant experience of this disposition of the natives, which often produced quarrels, and sometimes even fatal effects. In their behaviour they are extremely lascivious, almost beyond credibility. A woman of distinction who visited Mr Banks, used the following ceremony on her first approach to the stranger. After laying down several young plantain leaves, a man brought a large bundle of cloth; which having opened, he spread it piece by piece on the ground, in the space between Mr Banks and his visitants. There were in all nine pieces: having spread three pieces one upon another, the lady came forward, and, stepping upon them, took up her garments all around her to her waist; she then turned three times round, after which she dropped the veil: when other three pieces were spread, she practised the same ceremony; and so the third time, when the last three pieces were laid out; after which the cloth was again rolled up, and delivered to Mr Banks as a present from the lady, who with her attending friend came up and saluted him. From the unbridled licentiousness of these people, the French gave this island the name of the *New Cythera*. Nay, to such a degree do they carry their libidinous excesses, that a number of the principal people, it is related, have formed themselves into a society, in which every woman is common to every man. This society is distinguished by the name of *Arreoy*, the members of which have meetings from which all others are excluded. At these meetings the passions are excited by a studied course of sensuality, and the coarsest and most brutal pleasures are enjoyed by the whole company. If, however, notwithstanding these excesses, any of the female members of this community should prove with child, unless she can procure some man to adopt the child as his own, not all the strong affections of a mother, if such are not entirely eradicated by a course of life subversive of the feelings as well as the modesty of nature, can save the life of the precondemned innocent; but the child as soon as born is smothered, and the mother is left at liberty to renew her former course of execrable prostitution. Should any man be found to cooperate with a woman in saving the life of a child, they are both excluded for ever from the *arreoy*, and are considered as man and wife. The woman from that time is distinguished by the term *whannow-now*, "the bearer of children;" which in this part of the world only is considered as a term of reproach; and so depraved are those people, that being a member of such a society is boasted of as being a privilege, instead of being stigmatized as the foulest crime. The arreoys enjoys several privileges, and are greatly respected throughout the Society islands, as well as at Otaheite; nay, they claim a great share of honour from the circumstance of being childless. Tupia, one of the most intelligent natives, when he heard that the king of England had a numerous offspring, declared that he thought himself much greater, because he belonged to the arreoys. That this society indulge themselves in promiscuous embraces, and that every woman is common to every man, is contradicted by Mr Forster. He says, that these arreoys choose their wives and mistresses from among the prostitutes; and from this circumstance, as well as their extreme voluptuousness, they have seldom any reason to dread the intrusion of children. He had the following circumstances related to him by Omi or Omiah, one of the natives, who was brought to England. He said, that the pre-eminence and advantages which a man enjoyed as arreoy were so valuable as to urge him against his own feelings to destroy his child; that the mother was never willing to consent to the murder; but that her husband and other arreoys persuaded her to yield up the child; and that where entreaties were not sufficient, force was sometimes made use of. But, above all, he added, that this action was always perpetrated in secret; insomuch, that not even the *totows* or attendants of the house were present; because, if it were seen, the murderers would be put to death.

Both men and women constantly wash their whole bodies three times a-day in running water, and are remarkably cleanly in their clothes. They are most expert swimmers, being accustomed to the water from their infancy. Captain Cook relates the following remarkable instance of their expertness. On a part of the shore where a tremendously high surf broke, insomuch that no European boat could live in it, and the best European swimmer, he was persuaded, would have been drowned, as the shore was covered with pebbles and large stones, yet here were 10 or 12 Indians swimming for their amusement. Whenever a surf broke near them, they dived under it, and rose again on the other side. The stern of an old canoe added much to their sport. This they took out before them, and swam with it as far as the outermost breach; when two or three getting into it, and turning the square end to the breaking wave, were driven in towards the shore with incredible rapidity, sometimes almost to the beach; but generally the wave broke over them before they got half way; in which case they dived, and rose to the other side with the canoe in their hands, and swimming out with it again were again driven back. This amazing expertness drew the Captain's attention for more than half an hour; during which time none of the swimmers attempted to come ashore, but seemed to enjoy the sport in the highest degree. At another time, one of the officers of the quarter-deck intending to drop a bead into a canoe for a little boy of six years of age, it accidentally missed the boat, and fell into the sea; but the child immediately leaped overboard, dived after it, and recovered it. To reward him for this feat, some more beads were dropped to him; which excited a number of men and women to amuse the officers with their amazing feats of agility in the water, and not only fetched up several beads scattered at once, but likewise large nails, which, from their weight, descended quickly to a considerable depth. Some of these people continued a considerable time under water; and the velocity with which they were seen to go down, the water being extremely clear, was very surprising. Here a green branch of a tree is used as an emblem of peace, in

Otaheite. in exact conformity to the custom of the ancient nations. We shall add an extract here from Captain Cook's last voyage to the Pacific ocean.

"Nothing could make a stronger impression at first sight, on our arrival here, than the remarkable contrast between the robust make and dark colour of the people of Tongataboo*, and a sort of delicacy and whiteness which distinguish the inhabitants of Otaheite. It was even some time before that difference could preponderate in favour of the Otaheiteans; and then only, perhaps, because as we became accustomed to them, the marks which had recommended the others began to be forgotten. Their women, however, struck us as superior in every respect; and as possessing all those delicate characteristics which distinguish them from the other sex in many countries. The beard, which the men here wear long, and the hair, which is not cut so short as is the fashion at Tongataboo, made also a great difference; and we cannot help thinking, that on every occasion they showed a greater degree of timidity and fickleness. The muscular appearance, so common amongst the Friendly islanders, and which seems a consequence of their being accustomed to much action, is lost here, where the superior fertility of their country enables the inhabitants to lead a more indolent life; and its place is supplied by a plumpness and smoothness of the skin; which, though perhaps more consonant with our ideas of beauty, is no real advantage, as it seems attended with a kind of languor in all their motions, not observable in the others. This observation is fully verified in their boxing and wrestling, which may be called little better than the feeble efforts of children, if compared to the vigour with which these exercises are performed at the Friendly islands.

* One of the Friendly islands.

"Personal endowments being in great esteem amongst them, they have recourse to several methods of improving them, according to their notions of beauty. In particular, it is a practice, especially amongst the *arreoy*, or unmarried men of some consequence, to undergo a kind of physical operation, to render them fair. This is done by remaining a month or two in the house; during which time they wear a great quantity of clothes, eat nothing but bread-fruit, to which they ascribe a remarkable property in whitening them. They also speak, as if their corpulence and colour, at other times, depended upon their food; as they are obliged, from the change of seasons, to use different sorts at different times.

"The graceful air and firm step with which these people walk are not the least obvious proof of their personal accomplishments. They consider this as a thing so natural, or so necessary to be acquired, that nothing used to excite their laughter sooner, than to see us frequently stumbling upon the roots of trees, or other inequalities of the ground.

"Their countenances very remarkably express the abundant mildness or good nature which they possess, and are entirely free from that savage keenness which marks nations in a barbarous state. One would, indeed, be apt to fancy that they had been bred up under the severest restrictions to acquire an aspect so settled, and such a command of their passions, as well as steadiness in conduct. But they are at the same time frank, cheerful, and good-humoured, though sometimes, in the presence of their chiefs, they put on a degree of gravity, and such a serious air, as becomes stiff and awkward, and has an appearance of reserve. Otaheite.

"Their peaceable disposition is sufficiently evinced from the friendly reception all strangers have met with who have visited them. Instead of offering to attack them openly or clandestinely, as has been the case with most of the inhabitants of these seas, they have never appeared in the smallest degree hostile, but on the contrary, like the most civilized people, have courted an intercourse with their visitors by bartering, which is the only medium that unites all nations in a sort of friendship. They understand barter (which they call *fukkatou*) so perfectly, that at first we imagined they might have acquired the knowledge of it by commercial intercourse with the neighbouring islands; but we were afterwards assured, that they had little or no traffic except with Feejee, from which they get the red feathers, and some few other articles which they esteem. Perhaps no nation in the world traffic with more honesty, and less distrust. We could always safely permit them to examine our goods, and to hand them about one to another; and they put the same confidence in us. If either party repented of the bargain, the goods were re-exchanged with mutual consent and good humour. Upon the whole, they seem possessed of many of the most excellent qualities that adorn the human mind, such as industry, ingenuity, perseverance, affability, and perhaps other virtues which our short stay with them might prevent our observing.

"The only defect sullying their character that we know of is their propensity to thieving, to which we found those of all ages and both sexes addicted, and to an uncommon degree. It should, however, be considered, that this exceptionable part of their conduct seemed to exist merely with respect to us; for in their general intercourse with one another, I had reason to be of opinion, that thefts do not happen more frequently (perhaps less so) than in other countries, the dishonest practices of whose worthless individuals are not supposed to authorize any indiscriminate censure on the whole body of the people. Great allowances should be made for the foibles of these poor natives of the Pacific ocean, whose minds we overpowered with the glare of objects, equally new to them as they were captivating. Stealing, amongst the civilized and enlightened nations of the world, may well be considered as denoting a character deeply stained with moral turpitude, with avarice unrestrained by the known rules of right, and with profligacy producing extreme indigence, and neglecting the means of relieving it. But at the Friendly and other islands which we visited, the thefts so frequently committed by the natives, of what we had brought along with us, may be fairly traced to less culpable motives. They seemed to arise solely from an intense curiosity or desire to possess something which they had not been accustomed to before, and belonging to a sort of people so different from themselves. And, perhaps, if it were possible that a set of beings seemingly as superior in our judgment as we are in theirs should appear amongst us, it might be doubted, whether our natural regard to justice would be able to restrain many from falling into the same error. That I have assigned the true motive for their propensity to this practice, appears from their stealing every thing indiscriminately at first sight,

sight, before they could have the least conception of converting their prize to any one useful purpose. But I believe, with us, no person would forfeit his reputation, or expose himself to punishment, without knowing before-hand how to employ the stolen goods. Upon the whole, the pilfering disposition of these islanders, though certainly disagreeable and troublesome to strangers, was the means of affording us some information as to the quickness of their intellects. For their small thefts were committed with much dexterity; and those of greater consequence with a plan or scheme suited to the importance of the objects. An extraordinary instance of the last sort was, in their attempts to carry away one of the Discovery's anchors at mid-day.

Their common diet is made up of at least nine-tenths of vegetable food; and I believe more particularly the *mahee*, or fermented bread-fruit, which makes part almost of every meal, has a remarkable effect upon them, preventing a costive habit, and producing a very sensible coolness about them, which could not be perceived in us who fed on animal food. And it is, perhaps, owing to this temperate course of life that they have so few diseases among them. See N° 8.

"They only reckon five or six which might be called chronic or national disorders; amongst which are the dropsy, and the *fesai*, or indolent swellings, before mentioned as frequent at Tongataboo. But this was before the arrival of the Europeans; for we have added to this short catalogue a disease which abundantly supplies the place of all the others, and is now almost universal. For this they seem to have no effectual remedy. The priests, indeed, sometimes give them a medley of simples, but they own that it never cures them. And yet they allow that in a few cases nature, without the assistance of a physician, exterminates the poison of this fatal disease, and a perfect recovery is produced. They say, that if a man is infected with it he will often communicate it to others in the same house, by feeding out of the same utensils, or handling them, and that, in this case, they frequently die, while he recovers; though we see no reason why this should happen. See N° 9.

"Their behaviour on all occasions seems to indicate a great openness and generosity of disposition. Omai, indeed, who, as their countryman, should be supposed rather willing to conceal any of their defects, has often said that they are sometimes cruel in punishing their enemies. According to his representation, they torment them very deliberately; at one time tearing out small pieces of flesh from different parts; at another taking out the eyes; then cutting off the nose; and lastly, killing them by opening the belly. But this only happens on particular occasions. If cheerfulness argues a conscious innocence, one would suppose that their life is seldom sullied by crimes. This, however, I rather impute to their feelings, which, though lively, seem in no case permanent; for I never saw them in any misfortune labour under the appearance of anxiety after the critical moment was past. Neither does care ever seem to wrinkle their brow. On the contrary, even the approach of death does not appear to alter their usual vivacity. I have seen them when brought to the brink of the grave by disease, and when preparing to go to battle; but in neither case ever observed their countenances overclouded with melancholy or serious reflection. Such a disposition leads them to direct all their aims only to what can give them pleasure and ease. Their amusements all tend to excite and continue their amorous passions; and their songs, of which they are immoderately fond, answer the same purpose. But as a constant succession of sensual enjoyments must cloy, we found that they frequently varied them to more refined subjects, and had much pleasure in chanting their triumphs in war, and their occupations in peace; their travels to other islands and adventures there; and the peculiar beauties, and superior advantages of their own island over the rest, or of different parts of it over other less favourite districts. This marks that they receive great delight from music; and though they rather expressed a dislike to our complicated compositions, yet were they always delighted with the more melodious sounds produced singly on our instruments, as approaching nearer to the simplicity of their own. Neither are they strangers to the soothing effects produced by particular sorts of motion, which in some cases seem to allay any perturbation of mind with as much success as music. Of this I met with a remarkable instance. For, on walking one day about Matavai Point, where our tents were erected, I saw a man paddling in a small canoe so quickly, and looking about with such eagerness on each side, as to command all my attention. At first I imagined that he had stolen something from one of the ships, and was pursued; but on waiting patiently saw him repeat his amusement. He went out from the shore till he was near the place where the swell begins to take its rise; and, watching its first motion very attentively, paddled before it with great quickness till he found that it overtook him, and had acquired sufficient force to carry his canoe before it, without passing underneath. He then sat motionless, and was carried along at the same swift rate as the wave, till it landed him upon the beach. Then he started out, emptied his canoe, and went in search of another swell. I could not help concluding, that this man felt the most supreme pleasure, while he was driven on so fast and so smoothly by the sea; especially as, though the tents and ships were so near, he did not seem in the least to envy, or even to take any notice of the crowds of his countrymen collected to view them as objects which were rare and curious. During my stay, two or three of the natives came up, who seemed to share his felicity, and always called out when there was an appearance of a favourable swell, as he sometimes missed it, by his back being turned, and looking about for it. By them I understood that this exercise, which is called *ehorooe*, was frequent amongst them; and they have probably more amusements of this sort, which afford them at least as much pleasure as skaiting, which is the only one of ours with whose effects I could compare it."

15 Language, &c.

The language of these islanders is soft and melodious; it abounds with vowels, and the pronunciation of it is easily acquired: but it was found excessively difficult to teach the natives to pronounce a single English word; probably not only from its abounding with consonants, but from some peculiarity in its structure; for Spanish and Italian words, if ending in a vowel, they pronounced with the greatest ease. A sufficient acquaintance has not been formed with it to determine whether it is copious or not; but it is certainly very imperfect, being totally without inflexion either of nouns or verbs. Few of the nouns have more than one case, and few of the verbs

Otaheite. verbs more than one tense. It was impossible to teach the islanders to pronounce the names of their guests. They called Captain Cook *Toote*; Mr Hicks, the first lieutenant, *Hete*, &c. and in this manner they formed names for almost every man in the ship. In some, however, it was not easy to find any traces of the original; and they were perhaps not mere arbitrary sounds, formed upon the occasion, but signified words in their own language; and it seems that they could perfectly remember these appellations at the distance of four years, by their enquiries after such gentlemen as were absent on the second voyage by name. Mr Monkhouse, a midshipman, they called *Matte*, which in their language signifies *dead;* because he commanded a party that killed a man for stealing a musket. The nearest imitation they could reach of King George, was by calling him *Kihiargo*. We have the following observations on this subject, in vol. ii. of Cook's last voyage to the Pacific ocean: "The language of Otaheite, though doubtless radically the same with that of New Zealand and the Friendly islands, is destitute of that guttural pronunciation, and of some consonants, with which those latter dialects abound. The specimens we have already given are sufficient to mark wherein the variation chiefly consists, and to show, that, like the manners of the inhabitants, it has become soft and soothing. During the former voyage, I had collected a copious vocabulary, which enabled me the better to compare this dialect with that of the other islands; and during this voyage I took every opportunity of improving my acquaintance with it, by conversing with Omai before we arrived, and by my daily intercourse with the natives while we now remained there (A). It abounds with beautiful and figurative expressions, which, were it perfectly known, would, I have no doubt, put it upon a level with many of the languages that are most in esteem for their warm and bold images. For instance, the Otaheiteans express their notions of death very emphatically, by saying, "that the soul goes into darkness; or rather into night." And, if you seem to entertain any doubt, in asking the question, "if such a person is their mother?" they immediately reply with surprise, "yes, the mother that bore me." They have one expression that corresponds exactly with the phraseology of the scriptures, where we read of the "yearning of the bowels."—They use it on all occasions, when the passions give them uneasiness, as they constantly refer pain from grief, anxious desire, and other affections, to the bowels, as its seat; where they likewise suppose all operations of the mind are performed. Their language admits of that inverted arrangement of words which so much distinguishes the Latin and Greek from most of our modern European tongues, whose imperfections require a more orderly construction, to prevent ambiguities. It is so copious, that for the bread-fruit alone, in its different states, they have above 20 names; as many for the taro root; and about 10 for the cocoa-nut. Add to this, that, besides the common dialect, they often expostulate in a kind of stanza or recitative, which is answered in the same manner."

A map of Otaheite, engraved for Captain Cook's first voyage, was taken out, and laid before Tuahow the high-admiral, without informing him of what it was; however, he immediately found it out, and was overjoyed to see a representation of his own country. He pointed out all the districts of it, naming every one of them in their order.

These people have a remarkable sagacity in foretelling the weather, particularly the quarter from whence the wind will blow. In their long voyages they steer by the sun in the day, and in the night by the stars; all of which they distinguish by separate names, and know in what part of the heaven they will appear in any of the months during which they are visible in their horizon. They also know the times of their annual appearing and disappearing, with more precision than would easily be believed by an European astronomer. Their time they seem to reckon by moons, 13 of which make a year. The day they divide into six parts, and the night into an equal number. They judge of the time of the day by the height of the sun, but they cannot ascertain the time of the night by the stars. In numeration, the greatest length they can go is 200; that is, when they have counted each of their fingers and toes ten times over. When they take the distance from one place to another, they express it by the time which is required to pass it.

15 Government. The government of the Otaheiteans seems greatly to resemble the early state of the European nations under the feudal system. Their orders of dignity are *eareerahie*, which answers to the king; *earee*, baron; *manahouni*, vassal; and *towtow*, villein. There are two kings in the island, one being the sovereign of each of the peninsulas of which it consists. Each of them is treated with great respect by all ranks, but does not appear to be invested with so much power as is exercised by the earees in their own districts. When the king, whom they called *O-Too*, made a visit to Captain Cook, the chiefs, who happened to be there before him, immediately stripped themselves in great haste. Captain Cook took notice of it; upon which they said *earee, earee*, signifying, that it was on account of O-Too being present; but this was the only outward token of respect they paid him, for they never rose from their seats, or made any other obeisance.

The *earees* are lords of one or more of the districts into which each of the peninsulas is divided, and of which there are 43 in the larger one. These parcel out their territories to the *manahounis*, who superintend the cultivation of the ground. The lowest class, called *towtows*, seem to be nearly under the same circumstances with the villeins in feudal governments. They do all the laborious work, cultivate the land, catch fish, fetch wood and water, &c. Each of the earees keeps a kind of court, and has a great number of attendants, chiefly the younger brothers of their own tribe, and among these some hold particular offices, but of which little more is known than some of their names.

In this country a child succeeds to his father's titles and authority as soon as he is born: and thus the king no sooner has a son born, than his sovereignty ceases.

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(A) See this vocabulary at the end of the second volume of Captain Cook's second voyage. Many corrections and additions to it were now made by this indefatigable inquirer; but the specimens of the language of Otaheite, already in the hands of the public, seem sufficient for every useful purpose.

A regent is then chosen; and the father generally retains his power under that title, until his child becomes of age. The child of the baron succeeds to the titles and honours of its father, as soon as it is born, as well as the son of the king; so that a baron who was yesterday called *earee*, and was approached with the ceremony of lowering their garments, so as to uncover the upper part of the body, is to-day, if his wife happens to be delivered of a child, reduced to the rank of a private man; all marks of respect being transferred to the child, if it is suffered to live, though the father still continues possessor and administrator of his estate. But the acquiescence which the lower class of people, or *towtows*, yield to the command of their chiefs, is very remarkable. They are not suffered to taste any animal food, although they are employed in feeding it for their lords. They endure patiently very severe blows, if, when collected into a large body, they in any manner press upon or annoy the king or a chief in his progress; and all this passive spirit is preserved without any power being lodged in the hands of the king to exact it; for he uses no military force, nor is even attended with body guards.

There are but few actions which are reckoned crimes among the Otaheiteans. Adultery, however, is sometimes punished with death: but in general, the woman escapes with a severe beating, and the gallant passes unnoticed. The regulation of public justice is not confined to the magistrate; for the injured party redresses his own wrong by inflicting whatever punishment he can upon the offender: but in matters of notorious wrong the chiefs sometimes interpose. The nobility have livery for their servants; and in proportion as the master's rank is more or less elevated, these sashes are worn higher or lower, being fastened close under the arms of the servants belonging to the chiefs, and going round the loins of those belonging to the lowest class of nobility. Several parts of the island seem to be private property, which descend to the heir of the possessor on his death, and the descent seems to fall indifferently on man or woman. Captain Cook was of opinion that the number of inhabitants on the whole island amounted to 204,000 including women and children.

The religious language of the Otaheiteans, like that of the Gentoo Bramins, is different from what is used in common discourse; but, according to the accounts we

17 Religion. have of their notions concerning the origin of the world, nothing can be more ridiculous. They imagine that the Supreme Deity, besides a great many female descendants, has one son named *Tane;* and to him they direct their worship, though they do not believe that the good or bad conduct of mankind here on earth makes them more or less acceptable to this divinity. They believe the existence of the soul after death, and of a greater or lesser degree of happiness to be then enjoyed: but they seem to have no conception of a state of punishment or of suffering hereafter. The share of happiness which they imagine every individual will enjoy in this future state, will be assigned to him according to the rank he holds on earth. We are not, however, told wherein they suppose the happiness of this future state to consist; but it is most probably a pretty exact imitation of a Mohammedan paradise, for these voluptuaries can hardly be supposed capable of imagining any pleasure independent of the intercourse of the sexes.

The priesthood seems to be hereditary in one family or tribe; and as it is said to be numerous, probably those of that order are restrained from becoming members of the arreoy: but whether or not any peculiar decorum is necessary to be observed, hath not yet appeared. These priests are professedly the men of science; but their knowledge is altogether frivolous and useless; for it consists in being conversant with the names of their different divinities, and such absurd traditions as have been handed down among them from one generation to another. Their religious notions being deposited in an unknown tongue, they are respected because they are not understood; and as the cure of the soul is no object of regard, the most important concern to these people, the cure of their bodies, is committed to the priests, and much parade is used in their attempts to recover the sick, though their remedies consist of ridiculous ceremonies and enchantments rather than any thing else.

The marriages of these people are merely secular contracts; but no one has a right to perform the operation of tattowing except the priests; and this being a custom universally adopted by the natives, it may be supposed that performing it is a very lucrative employment. The males in general undergo a kind of circumcision, which it is disgraceful not to comply with, and which is likewise the exclusive privilege of the priests to perform. But what most establishes the credit of this order of men is their skill in astronomy and navigation.

Captain Cook, who had some reason to believe that among the religious customs of this people, human sacrifices were sometimes offered up to their deities, went to a morai, or place of worship, accompanied by Captain Furneaux, having with them a sailor who spoke the language tolerably well, and several of the natives. In the morai was a tupapow, a kind of bier, with a shed erected over it, on which lay a corpse and some provisions. Captain Cook then asked if the plantain were for the Eatua? If they sacrificed to the Eatua hogs, dogs, fowls, &c.? To all of which an intelligent native answered in the affirmative. He then asked if they sacrificed men to the Eatua? He was answered, *taato eno*, "bad men they did; first *tiparrahy*, beating them till they were dead." He then asked if good men were put to death in this manner? His answer was no, only *taato eno*. The Captain then asked if any earees were? The native replied, they had hogs to give the Eatua, and again repeated *taato eno*. He was then asked if towtows, who had no hogs, dogs, or fowls, but yet were good men, were ever sacrificed to the Eatua? The answer still was no, only bad men. Many other questions were put to him; all his answers to which seemed to confirm the idea that men for certain crimes were condemned to be sacrificed to the gods, provided they did not possess any property which they might give for their redemption. However, in pursuing such inquiries as these, no certain information could be obtained, on account of the slight knowledge which had been acquired of the language of the country: but according to farther accounts which Captain Cook received from Omai, it seems to rest with the high-priest to single out the victims for sacrifice; who, when the people are assembled on any solemn occasion, retires alone into the house of God, and stays there for some time; when he comes out, he informs the assembly that he has seen and conversed with the great god (the high priest alone having that privilege), and that he has asked for a human sacrifice; and tells them he has desired such a person, Otaheite. person, naming a man present, who has most probably, on some account or other, rendered himself obnoxious to this ghostly father. The words are no sooner gone out of his mouth, than the devoted wretch is put to death; for his guilt cannot be doubted, after the oracle has pronounced his doom.

On this island was seen the figure of a man constructed of basket work, rudely made, but not ill designed: it was something more than seven feet high, and rather too bulky in proportion to its height. This wicker skeleton was completely covered with feathers, which were white where the skin was to appear, and black in the parts which it is their custom to paint or stain, as well as upon the head, which was designed to represent hair. Upon the head also were four protuberances, three in front, and one behind, which the Indians called *tate ete*, little men. The image was called *Monioe;* it was a representation of *Mauwe*, one of their Eatuas, or gods of the second class, and was said to be the only one of the kind on Otaheite.

These people pray at sunrise and sunset. They have also a number of superstitious practices, in order to conciliate the influence of evil genii. E-Tee, a chief, who seemed to be the king's prime minister in 1774, very seriously asked Mr Forster whether they had a god (*Eatua*) in their country, and whether they prayed to him (*epore?*) When he told them that they acknowledged a divinity who had made every thing, and was invisible, and that they were accustomed to address their petitions to him, he seemed to be highly pleased, and repeated his words with comments of his own, to several persons who sat round him; seeming thereby to intimate, that the ideas of his countrymen corresponded with theirs in this respect.

The morais are used both as burying-grounds and places of worship; they are approached with the most wonderful expressions of reverence and humility; and this, it should seem, not because any thing there is esteemed sacred, but because they there worship an invisible being, for whom they entertain the most reverential respect, although not excited by the hope of reward or the dread of punishment. Though they do not appear to have any visible object of worship, yet, says Captain Cook, this island, and indeed the rest that lie near it, have a particular bird, some a heron, and others a king's-fisher, to which they pay a particular regard, and concerning which they have some superstitious notions, respecting good or bad fortune, as we have of the swallow and robin redbreast, and will on no account molest or kill them. One of these cemeteries, or places of worship, was known to Captain Cook, on his first voyage, by the name of Tootahah's morai, then the regent; but when, on his second voyage, after the death of that chief, he called it by that name, Maratata, a chief that accompanied the party, interrupted him, intimating, that it was no longer Tootahah's after his death, but was then known as O-Too's morai, the then reigning prince. A fine moral for princes! daily reminding them of mortality whilst they live, and teaching them, that after death they cannot call even that ground their own which their dead corpse occupies! The chief and his wife, on passing by it, took their upper garments from their shoulders. From hence it would seem, that the royal family have a particular morai, and that it always bears the name of the reigning prince.

15 Funerals. An Indian who had snatched away a musket from a sentry whilst on duty, was, by the inhumanity of a midshipman who commanded the guard, pursued and shot. The unhappy fate of this poor fellow gave an opportunity for seeing the manner in which these people treat their dead. They placed the corpse in the open air till the bones became quite dry: a shed was erected close by the house where the deceased had resided; it was about 15 feet long, and 11 broad; one end was left quite open; the other end, and the two sides, were partly inclosed with a sort of wicker-work. The bier was a frame of wood, like that on which the sea-beds, called *cots*, are placed, with a matted bottom, and supported by four posts, at the height of about four feet from the ground. The body was covered first with a mat, and then with white cloth; by the side of it lay a wooden mace, one of their weapons of war; and near the head of it, which lay next to the close end of the shed, lay two cocoa-nut shells; at the other end a bunch of green leaves, with some dried twigs, all tied together, were stuck in the ground, by which lay a stone about as big as a cocoa-nut. Near these lay one of the young plantain-leaves that are used for emblems of peace, and close by it a stone axe. At the open end of the shed also hung, in several strings, a great number of palm nuts; and without the shed was stuck up in the ground a stem of a plantain tree, about six feet high, upon the top of which was placed a cocoa-nut shell full of fresh water; against the side of one of the posts hung a small bag, containing a few pieces of bread-fruit ready roasted, which had not been put in all at one time, some being fresh and others stale. This minute examination of their manner of treating their dead, seemed to be very unwelcome to the natives. The food so placed by the corpse is designed as an offering to their gods. They cast in, near the body, small pieces of cloth, on which the tears and blood of the mourners have been shed; for in their paroxysms of grief it is an universal custom, to wound themselves with a shark's tooth. The mourner is always a man; and he is dressed in a very singular habit. When the bones are stripped of their flesh, and become dry, they are buried. This regard to their dead is very remarkable: one of the ship's company happening to pull a flower from a tree which grew on one of their sepulchral inclosures, an Indian came suddenly behind him and struck him; and a party of sailors, who were sent to get some stones for ballast for the ship, had like to have been embroiled by the natives, by pulling down some part of an inclosure of this kind. This shed under which their dead are laid is called *tupapow;* the inclosure in which their bones are deposited is called *morai;* these latter, as has been already related, are also places of worship. As soon as a native of Otaheite is known to be dead, the house is filled with relations, who deplore their loss; some by loud lamentations, and some by less clamorous, but more genuine expressions of grief. Those who are in the nearest degree of kindred, and are really affected by the event, are silent; the rest are one moment uttering passionate exclamations in a chorus, and the next laughing and talking without the least appearance of concern. In this manner the remainder of the day on which they assemble is spent, and all the succeeding night. On the next

next morning the body is shrouded in their cloth, and conveyed to the sea-side on a bier, which the bearers support upon their shoulders, attended by the priest, who having prayed over the body, repeats his sentences during the procession. When it arrives at the water's edge, it is set down upon the beach; the priest renews his prayers, and taking up some of the water in his hands, sprinkles it towards the body, but not upon it. It is then carried back 40 or 50 yards; and soon after brought again to the beach, where the prayers and sprinkling are repeated. It is thus removed backwards and forwards several times; and while these ceremonies have been performing, a house has been built, and a small space of ground railed in. In the centre of this house, or *tupapow*, as they term it, posts are set up to support the bier, which is at length conveyed thither, and placed upon it; and here the body remains to putrefy, till the flesh is wholly wasted from the bones. These houses of corruption are of a size proportioned to the rank of the person whose body they are to contain. Those allotted to the lower class are just sufficient to cover the bier, and have no railing round them. The largest that was seen was 11 yards long; and such are ornamented according to the abilities and inclination of the surviving kindred, who never fail to lay a profusion of good cloth about the body, and sometimes almost cover the outside of the house. Garlands of the fruit of the palm nut, or pandanus, and cocoa-leaves, twisted by the priests in mysterious knots, with a plant called by them *ethee no morai*, which is particularly consecrated to funeral solemnities, are deposited about the place; provision and water are also left at a little distance. As soon as the body is deposited in the tupapow, the mourning is renewed. The women assemble and are led to the door by the nearest relation, who strikes a shark's tooth several times into the crown of her head; the blood copiously follows, and is carefully received upon pieces of linen, which are thrown under the bier. The rest of the women follow this example; and the ceremony is repeated at the interval, of two or three days, as long as the zeal and sorrow of the parties hold out. The tears also which are shed upon these occasions are received upon pieces of cloth, and offered as oblations to the dead. Some of the younger people cut off their hair, and that is thrown under the bier with the other offerings. This custom is founded on a notion, that the soul of the deceased, which they believe to exist in a separate state, is hovering about the place where the body is deposited; that it observes the actions of the survivors, and is gratified by such testimonies of their affectionate grief. Whilst these ceremonies are carrying on by the women, the men seem to be wholly insensible of their loss; but two or three days after, they also begin to perform a part. The nearest relations take it in turn to assume the dress, and perform the offices.

The chief mourner carries in his hand a long flat stick, the edge of which is set with sharks' teeth; and in a frenzy, which his grief is supposed to have inspired, he runs at all he sees, and if any of them happen to be overtaken, he strikes them most unmercifully with his indented cudgell, which cannot fail to wound them in a dangerous manner. The processions continue at certain intervals for five moons; but are less and less frequent, by a gradual diminution, as the end of that time approaches. When it is expired, what remains of the body is taken down from the bier; and the bones, having been scraped and washed very clean, are buried, according to the rank of the person, either within or without a morai. If the deceased was an earee, or chief, his skull is not buried with the rest of his bones, but is wrapped up in fine cloth, and put in a kind of box made for that purpose, which is also placed in the morai. This coffin is called *ewharre no te oremetua*, "the house of a teacher, or master." After this the mourning ceases, except some of the women continue to be really afflicted at the loss, and in that case they will suddenly wound themselves with the shark's tooth wherever they happen to be. The ceremonies, however, do not cease with the mourning; for prayers are still said by the priest, and offerings made at the morai. Some of the things, which from time to time are deposited there are emblematical; a young plantain is said to represent the deceased, and a bunch of feathers the Deity who is invoked. The priest places himself over against the symbol of the god, accompanied by some of the relations, who are furnished with a small offering: he repeats his orison in a set form, consisting of separate sentences: at the same time weaving the leaves of the cocoa-nut into different forms, which he afterwards deposits upon the ground where the bones have been interred: The Deity is then addressed by a shrill screech, which is used only upon that occasion. When the priest retires, the tuft of feathers is removed, and the provisions are left to putrefy, or be devoured by the rats.

This ceremony of mourning, as described above, was performed by Tirope, one of the wives of Tubourai Tamaide; who, when the bleeding from the wounds which she had thus given herself ceased, looked up with a smile on the company round her, and who had before inquired of her, very earnestly, the cause of her behaviour, without receiving any answer, or having been at all noticed by her. She then began to pick up some small pieces of cloth which she had spread to catch the blood; and having got them all together, she went to the shore, and threw them into the sea. She then plunged into the river; and having washed her whole body, returned to the company as cheerful as ever. To add to the singularity of this conduct, the Indians who stood round her all the time that this frantic distress was performing, conversed with great indifference and jocularity.

There is not a more ancient custom handed down to us than that of cutting the body to express grief and distress of mind. In the code of laws delivered by Moses to the Israelites, 1400 years before the Christian era, this practice is expressly forbidden to that people: "Ye shall not cut yourselves, or make any baldness between the eyes for the dead," Deut. xiv. i. Hence it may be supposed that this rite prevailed in Egypt, from whence the Jews derived most of those propensities which were inhibited by their great legislator. We are told likewise in the book of Kings, of the priests of Baal wounding themselves, after they had long waited in vain for the supernatural intervention of their idol. D'Arvieux informs us, that the modern Arabs retain the same custom, and that the part they chiefly wound is their arms. The difference in the practice as now prevailing in Otaheite and Arabia seems to be, that in the first none but the women make use of it, and in the latter it is confined to the men, and generally used to express their desperate passion for some favourite mistress.

The

The mourning which is worn here is a head dress of feathers, the colour of which is consecrated to death, and a veil over the face. This dress is called *eeva*. The whole nation is said to appear thus on the death of their king. The mourning for fathers is very long. The women mourn for their husbands, but not the husbands for their wives.

We shall conclude this account of Otaheite with the history of *Omai*, or, as he is improperly called *Omiah*, who was brought over to England. He was a native of Ulietea, or Raietea; and embarked at Huaheine with Captain Furneaux, on board the Adventure, in September 1773; and the two ships separating in a storm on the coast of New Zealand a few months afterwards, the voyage of the Adventure was brought to a much earlier conclusion than that of the Resolution, for she arrived at Spithead the 14th of July following. This youth is said to have had some property in his native soil, of which he was dispossessed by the people of Bolabola: but he was not one of the earees, or gentry of that country, but of the middling class of people. He was eminent neither for figure, shape, nor complexion; his colour being of a deep hue, resembling a towtow, or one of the common people; and both Captain Cook and Mr Forster agree in thinking him no proper sample of the inhabitants of those islands, in respect of personal beauty. However, they are both of opinion, that the qualities of his heart and head resembled those of his countrymen in general, and that no one of the natives would have given more general satisfaction by his behaviour whilst he remained in England. He is described as possessing a good understanding, quick parts, and honest principles: not an extraordinary genius like Tupia; yet not at all deficient in intelligence, which appears from his knowledge of the game of chess, in which he made an amazing proficiency. His principal patrons, whilst in England, were, the earl of Sandwich, Mr Banks, and Doctor Solander. His noble patron introduced him to his majesty at Kew; and, during his stay in England, he was caressed by many of the principal nobility. He naturally imitated that easy and elegant politeness which is prevalent among the great, and which is one of the ornaments of civilized society. Indeed he adopted the manners, the occupations, and amusements of his companions in general, and gave many proofs of a quick perception and a lively fancy. He appears, however, to have been treated, whilst he resided here, rather as a fashionable exhibition, than as a rational being. No attention seems to have been paid to the enriching his mind with useful knowledge, such as might have rendered him a valuable acquisition to his country on his return thither; no means were used to instruct him in agriculture, or any mechanical art or useful manufacture; and, above all, to possess him with a moral sense: to teach him the exalted ideas of virtue, and the sublime principles of revealed religion. After a stay of two years in England, and having been inoculated for the smallpox, he embarked with Captain Cook, on board the Resolution, on his return home, loaded with a profusion of presents. At parting with his friends here, his tears flowed plentifully, and his whole behaviour bespoke him to be sincerely affected at the separation: but though he lived in the midst of amusement during his residence in England, his return to his native country was always in his thoughts; and though he was not impatient to go, he expressed a satisfaction as the time of his return approached.

Such is the account of this people which our limits permit us to give. In the history of mankind it is not without importance: and in the hands of the philosopher, the moralist, or the divine, it may be useful. The subject, because but new, has been much agitated, and is pretty generally known. Such of our readers as make men and manners their peculiar study, will be anxious for further information; we must refer them, however, to those authors who have written particularly and copiously on the subject. Cook and other voyagers of eminence will at least command attention. We may just remark, that there must surely be something extremely fascinating in the persons, manners, or customs of the inhabitants, or in the soil and appearance of the country, that could tempt the greater part of a ship's crew to resist authority, and forcibly to return to Otaheite; yet such we know was the case; and the sufferings of the commander, and those who refused to join in this vile conspiracy, and who were therefore exposed in an open boat, were indeed shocking. An account of it has been published.

OTALGIA, the EAR-ACH. See MEDICINE *Index*.

OTELANDS, or OATLANDS, in England, in the county of Surrey, near Weybridge, was formerly a royal palace, wherein Henry duke of Gloucester, third son to King Charles I. was born; and had a deer park, which in the civil wars was by the parliament laid open, and the house demolished. In 1673 there was a brick wall remaining, which encompassed ten acres; but there were then small traces of the chief pile, besides the gardener's lodge, wherein was the silk-worm room raised by King James I.'s queen. It is now a most magnificent building, and commands a most extensive and beautiful prospect. In the park there was a paddock, where Queen Elizabeth used to shoot with a cross-bow. It is now the property of his royal highness the duke of York, who purchased it for 43,000l. of the duke of Newcastle, 1789.

ORTFORD, a village in England, in the county of Kent, which stands at the bottom of a hill. In 793 there was a battle at this place, between the two Saxon kings, Offa of Mercia, and Alrick of Kent, who was killed by Offa; and another in 1016, wherein the Danish king Canute was routed by King Edmund Ironside. The said Offa, to atone for the blood he had shed in that battle, first gave this place to Christ-church, Canterbury (as the deed says) *in pascua porcorum*, "for the support of the archbishop's hogs;" and so it remained in the archbishop's liberty, till exchanged with King Henry VIII. for other lands. There was a chantry founded at the Ryehouse in this parish. The church was once a chapel to Shoreham.

OTHNIEL, in sacred history, the son of Kenaz, of the tribe of Judah. We are told (Josh. xv. 17.), that Othniel was brother to Caleb; and (Judges i. 13.) it is expressly said, that he was Caleb's younger brother. There are, however, some difficulties in this: for if Caleb and Othniel had been brothers, the latter could not have married his niece Achsah the daughter of Caleb. Secondly, the scripture never assigns to Caleb and Othniel the same father; it always names Kenaz as father to Othniel, and Jephunneh as the father of Caleb. Lastly, Caleb must be much older than Othniel, since he

Othniel, Otho.

he gave Othniel his daughter Achsah in marriage. Thus it seems much better to suppose Kenaz and Jephunneh to be two brothers, and that Othniel and Caleb were cousin-germans, and in this sense to be nearly related, or brothers, according to the language of scripture. Thus Achsah being but second cousin in respect of Othniel, he might marry her without doing any thing contrary to the letter of the law.

Caleb having received his portion in the mountains of Judah, in the midst of a country that was possessed by giants of the race of Anak, after he had taken the city of Hebron, he advances towards Debir, otherwise called *Kirjath-sepher*, and declares that he would give his daughter Achsah in marriage to him that should take Kirjath-sepher. Othniel took it, and had Achsah to wife.

After the death of Joshua, the Israelites not giving themselves the trouble to exterminate the Canaanites that were then in the land, and not having continued in their fidelity to the Lord, he delivered them over to Chushan-rishathaim king of Mesopotamia (Judges iii. 8, &c.) to whom they continued in subjection for eight years. Then they cried to the Lord, who raised them up a deliverer in the person of Othniel the son of Kenaz, who was filled with the spirit of God, and judged Israel. He came into the field and gave battle to Chushan-rishathaim, beat him, and delivered Israel, in the year of the world 2599; and the country was at rest for 40 years. After this Othniel died; but the precise year of his death is not known.

OTHO, M. Salvius, a Roman emperor, born A. D. 32, of a family descended from the ancient kings of Etruria. He was among the number of Nero's favourites, and accordingly was raised to the highest offices of the state, and made governor of Pannonia by the interest of Seneca, who wished to remove him from Rome, lest Nero's love for Poppæa should prove his ruin. After Nero's death, Otho conciliated the favour of Galba the new emperor; but when he did not gain his point, and when Galba refused to adopt him as his successor, he resolved to make himself absolute, without any regard to the age or dignity of his friend. The great debts which he had contracted encouraged his avarice; and he procured the assassination of Galba, and made himself emperor. He was acknowledged by the senate and the Roman people; but the sudden revolt of Vitellius in Germany rendered his situation very precarious, and it was mutually resolved that their respective right to the empire should be decided by arms. Otho obtained three victories, but in a general engagement near Brixellum, his forces were defeated, and he stabbed himself when all hopes of success had vanished. This happened about the 37th year of his age, after a reign of about three months. It has been justly observed, that the last moments of Otho's life were those of a philosopher. He comforted his soldiers who lamented his fortune, and he expressed his concern for their safety when they earnestly solicited to pay him the last friendly offices before he stabbed himself; and he observed, that it was better that one man should die than that all should be involved in ruin on account of his obstinacy. His nephew was much affected, and feared exceedingly the anger and haughtiness of the conqueror; but Otho comforted him, and observed, that Vitellius would be kind and affectionate to the friends and relations of Otho, since Otho was not ashamed to say, that in the time of their greatest enmity the mother of Vitellius had received every friendly treatment from his hands. He also burnt the letters which, by falling into the hands of Vitellius, might provoke his resentment against those who had favoured the cause of an unfortunate general. These noble and humane sentiments in a man who was the associate of Nero's shameful pleasures, and who had stained his hand in the blood of his master, have appeared to some wonderful, and have passed for the features of policy, and not of a naturally virtuous and benevolent heart. His father was a favourite of Claudius.

Otho.

Otho, a tribune of the people, who, in Cicero's consulship, made a regulation to permit the Roman knights at public spectacles to have the 14 first rows after the seats of the senators. This was opposed with virulence by some, but Cicero ably defended it, &c.

Otho, *Venius*, a very celebrated Dutch painter. He was descended of a considerable family in Leyden, and was born in 1556. He was carefully educated by his parents in the belles lettres, and at the same time learned to design of Isaac Nicholas. He was but 15 when the civil wars obliged him to leave his country. He retired to Liege, finished his studies, and there gave the first proofs of the excellence of his mind. He was well known to Cardinal Groosbeck, who gave him letters of recommendation when he went to Rome, where he was entertained by Cardinal Maduccio. His genius was so active, that he applied himself to philosophy, poetry, mathematics, and painting, all at once. He became a great proficient in designing under Frederico Zuchero. He acquired an excellence in all the parts of painting, especially in the knowledge of the claro-obscuro; by which means he came to be accounted one of the most ingenious men of his age. He lived at Rome seven years, during which time he performed several rare pieces; and then passing into Germany, was received into the service of the emperor. After this the duke of Bavaria and the elector of Cologne employed him; but all the advantages he got from the courts of foreign princes could not detain him there. He had a desire to return into the Low Countries, of which Alexander Farnese, prince of Parma was then governor. He drew the prince's picture, armed cap-a-pee, which confirmed his reputation in the Netherlands. After the death of that prince, Venius returned to Antwerp, where he adorned the principal churches with his paintings. The archduke Albert, who succeeded the prince of Parma in the government of the Low Countries, sent for him to Brussels, and made him master of the mint, a place which occupied much of his time, yet he found some time for the exercise of his profession. He drew the archduke and the infanta Isabella's portraits at large, which were sent to James I. of Great Britain: and, to show his knowledge of polite learning likewise, he published several treatises, which he embellished with cuts of his own designing. Louis III. made him very great offers to tempt him into his service; but he would never leave his own country, satisfying himself with the character and employments he held there. He was the first, after Polydore Caravaggio, who reduced the claro-obscuro to a principle of the art of painting. Rubens perfected what he began, and the whole Flemish school learned

learned it of him. Venius died at Brussels, 1634, in his 78th year. He had two brothers, Gilbert, who was a graver, and Peter a painter. He had also the honour of breeding up the famous Rubens in his art.

OTHONNA, a genus of plants belonging to the syngenesia class; and in the natural method ranking under the 49th order, *Compositæ*. See BOTANY *Index*.

OTHRYADES, one of the 300 Spartans who fought against 300 Argives, when those two nations disputed their respective right to Thyreata. Two Argives, Alcinor and Cronius, and Othryades, survived the battle. The Argives went home to carry the news of their victory; but Othryades, who had been reckoned among the number of the slain on account of his wounds, recovered himself, and carried some of the spoils of which he had stripped the Argives into the camp of his countrymen; and after he had raised a trophy, and had written with his own blood the word *vici* on his shield, he killed himself, unable or unwilling to survive the death of his countrymen.

OTIS, a genus of birds belonging to the order of gallinæ. See ORNITHOLOGY *Index*.

OTLEY, a town of England, in the west riding of Yorkshire, under a cliff called *Chevin*, on the south side of the river Wherfe. The adjacent parts are reckoned the most delightful in England. Its church has lately been elegantly fitted up, in which are several good old monuments. The adjacent country is much improved, and from the Chevin is a most beautiful view of an extensive scope of undescribed mansions. This manor was given by Athelstan to the see of York, whose archbishop had a palace here, with several extensive privileges. There is a free grammar school in this place, founded by Mr Cave, 1611, called *Prince Henry's School*. In 1811 the inhabitants amounted to 2602. In 1673, it suffered much by an inundation; which carried away several bridges, mills, &c. as well as much corn, &c. W. Long. 1. 50. N. Lat. 53. 54.

OTODINI, ancient Britons, seated, as some suppose, to the north-east of the Brigantes, in the countries now called Northumberland, Merse, and the Lothians. As the Otodini are not mentioned by any of the Roman historians, but only by Ptolemy, it is uncertain whether they formed a distinct independent state, or were united with the Brigantes. They were however, a considerable people, and possessed a long tract of the sea-coast, from the river Tine to the frith of Forth. Their name is derived by Baxter from the old British words *Ot o dineu*, which signify "a high and rocky shore;" descriptive enough of their country. They were probably reduced by Agricola at the same time with their more powerful neighbours the Brigantes; but as they lived without the wall of Severus, they were, like the rest of the Mæatæ, engaged in frequent revolts. In the most perfect state of the Roman government in this island, the country of the Otodini made a part of the Roman province called Valentia; which comprehended all that large tract between the two walls. As this province was never long together in the peaceable possession of the Romans, they had but few stations in the country of the Otodini, except those on the line of the wall of Severus.

Henry's Hist Gr Brit. vol. i. p. 185, &c.

Various authors have derived the name of this people in various ways, and it is very differently spelled; and various opinions still seem to be entertained among the learned respecting their real situation: and it is even doubtful whether their country was in England or in Scotland. The celebrated Drummond of Hawthornden contends for the latter.

OTRANTO, or TERRA D'OTRANTO, a province of Italy in the kingdom of Naples; bounded on the north by the Terra di Bari and by the gulf of Venice, on the east by the same gulf, and on the south and west by a great bay which is between that and the Basilicata. It is a mountainous country, abounding in figs, olives, and wine. It is often visited by locusts, and by Algerine pirates, who carry off all the people they can catch into slavery. But to keep them off, there are a great many forts on the coasts.

OTRANTO, a city of Italy, in the kingdom of Naples, and capital of the province of the same name, with a commodious harbour, an archbishop's see, and a strong citadel, where the archbishop resides. Mr Swinburne * gives this account of it: "It is (says he) small, stands on a hill, and contains only 3000 inhabitants. Its little harbour is not so bad but it might induce more people to settle here, as no port on the coast lies so convenient for traffic with Greece. The Adriatic gulf is here but 60 miles wide. I climbed to the top of a tower to get a sight of the Acroceraunian mountains; but a vapour hanging over the sea, along the horizon, hid them from my view: in a clear morning, their snowy tops are said to be very visible. The cathedral of Otranto is Gothic, and, according to the Puglian fashion, has its subterraneous sanctuary. The columns are of beautiful marble and granite; the pavement, a rude species of mosaic, commonly called *Saracenic*: As it is to be met with in all churches founded by the Norman kings of Sicily, the artists who laid it were probably Saracens, or at least Greeks, their scholars. These mosaics are composed of pieces of porphyry, serpentine, and cubes of gilt glass,—disposed in stars, circles, or chequers. The compartments of the stalls are bordered with them; and the small twisted columns, which support the pulpits and canopies, are ornamented with a spiral stripe of the same work. It is a pity so much durability, compactness, and beauty of materials, should have been lavished on such barbarous designs. Otranto was a Roman colony, as is certified by an inscription, almost the only monument of antiquity left there (A). In the 10th century it was made an archbishop's see. In 1480, Laurence de Medici, to deliver himself from the attacks of the king of Naples, persuaded Mahomet II. to invade the realm; and Otranto was the unfortunate place where the Turks landed. It was invested, stormed, and pillaged. Its prelate was slain at the door of his church; 800 principal citizens dragged out of the gates and butchered; their bodies left 12 months unburied, till the duke of Calabria retook the city, and committed them to hallowed earth. About 100 years after, a devout person affirmed, that these bones had appeared to him in a dream;

* *Travels in the two Sicilies*, vol. i.

(A) "Num. Hydr.—ÆR Caput barb. et laureat. ΥΔΡΟΝΤΙΝΩΝ. = Tridens, cum duobus delphinibus."

dream; and, upon the strength of his vision, they became, for the vulgar, objects of almost equal veneration with the relicks of the primitive martyrs."

OTRICOLI, a small town of Italy, in the ecclesiastical state, and in the duchy of Spoletto, in E. Long. 12. 23. N. Lat. 42. 26. situated on a rising ground on the frontiers of the patrimony of St Peter. From this town is seen a fine plain, and some of the windings of the famous river Tiber. The ruins that are scattered here and there at the entrance of the plain, descending from Otricoli, are thought to be the remains of the ancient Otricolum; they consist of some shapeless fragments of columns, cornices, and other pieces of marble. In the middle of the great street of Otricoli, there is a marble pedestal, upon which you see an inscription, showing they had erected a statue to Julia Lucilla, who had built public baths at Otricoli at her own expence.

OTTER. See MUSTELA, MAMMALIA *Index*.

OTTER of Roses. See ROSES.

OTTERBURN, in England, near Ellesdon, in the county of Northumberland, was the field of battle between the English and Scots in 1388, wherein Henry Percy, called *Hotspur*, was taken prisoner, and Douglas the Scotch general was killed. On this battle was founded the delightful old balled of Chevy chase; the village being situated by the river Rhead, on the south side of the Cheviot hills. The entrenchments are still visible; and a number of tumuli scattered over the adjacent ground mark to future ages the slaughter made there.

OTTERY, ST MARY'S, a market town in Devonshire, situated 159 miles west of London, and 10 miles east of Exeter. The church is very ancient, and somewhat resembles a cathedral. A very extensive woollen manufactory was lately established here by Sir George Yonge, and Sir John Duntze, Barts. It has no corporation. It derived its name, as some suppose, from the river Otter, and that from the otters formerly found in it. This town was given by King Edward the Confessor to the church of St Mary at Rouen in Normandy; but was afterwards bought by Grandison bishop of Exeter; who made of it a quarter college in 10 Edward III. and therein placed secular priests, with other ministers, to whom he gave the whole manor, parish tythes, fines, spiritual profits, &c. which amounted to 304l. 2s. 10d. yearly. The population in 1811 was 2880.

OTWAY, THOMAS, an eminent tragic poet, was the son of Mr Humphry Otway, rector of Wolbeding in Sussex; and was born at Trottin in that county on the 3d of March 1651. He was educated at Oxford; when, leaving the university without a degree, he retired to London, when he commenced player, but with indifferent success. However, the sprightliness of his conversation gained him the favour of Charles Fitz-Charles earl of Plymouth, who procured him a cornet's commission in one of the new raised regiments sent into Flanders; but he returned from thence in very necessitous circumstances, and applied himself again to writing for the stage. In comedy he has been deemed too licentious; which, however, was no great objection to his pieces in the profligate days of Charles II. But, in tragedy, few English poets have ever equalled him; and perhaps none ever excelled him in touching the passions, particularly the tender passion. There is generally something familiar and domestic in the fable of his tragedies, and there is amazing energy in his expression.—The heart that doth not melt at the distresses of his Orphan must be hard indeed! But though Otway possessed in so eminent a degree the rare talent of writing to the heart, yet he was not very favourably regarded by some of his cotemporary poets, nor was he always successful in his dramatic compositions. After experiencing many reverses of fortune in regard to his cirumstances, but generally changing for the worse, he at last died wretchedly in a public house on Tower-hill; whither, it is supposed, he had retired, in order to avoid the pressure of his creditors. Some have said, that downright hunger compelling him to fall too eagerly on a piece of bread, of which he had been for some time in want, the first mouthful choked him, and instantly put a period to his days. Dr Johnson gives this account of the matter: "He died in a manner which I am unwilling to mention. Having been compelled by his necessities to contract debts, and hunted, as is supposed by the terriers of the law, he retired to a public house on Tower-hill, where he died of want; or, as it is related by one of his biographers, by swallowing, after a long fast, a piece of bread which charity had supplied. He went out, as is reported, almost naked, in the rage of hunger, and finding a gentleman in a neighbouring coffee-house, asked him for a shilling. The gentleman gave him a guinea; and Otway going away bought a roll, and was choked with the first mouthful. All this, I hope, is not true; but that indigence, and its concomitants, sorrow and despondency, brought him to the grave, has never been denied."

Johnson speaks of him in nearly these terms: Otway had not much cultivated versification, nor much replenished his mind with general knowledge. His principal power was in moving the passions, to which Dryden in his latter years left an illustrious testimony. He appears, by some of his verses, to have been a zealous royalist; and had what was in those times the common reward of loyalty; he lived and died neglected.—His dramatic writings are nine in number; the most admired of which are, *The Orphan*, and *Venice Preserved*. He had also made some translations, and wrote several miscellaneous poems. His whole works are printed in two pocket volumes. He wrote four acts of a play which are lost.

OVAL, an oblong curvilinear figure, otherwise called *ellipsis*. (See ELLIPSIS). However, the proper oval, or egg shape, differs considerably from that of the ellipsis, being an irregular figure, narrower at one end than at another: whereas the ellipsis or mathematical oval, is equally broad at each end; though it must be owned, these two are commonly confounded together; even geometricians calling the oval a *false ellipsis*.

OVARY, in *Anatomy*, that part of a female animal wherein the ova or eggs are formed or lodged. See ANATOMY, N° 111.

OVARIUM, in *Botany*, a name by which botanists who are fond of assimilating the animal and vegetable kingdoms have distinguished the germen or seed bud, as containing the rudiments of the future seed.

OVATION, in the Roman antiquity, a lesser triumph, allowed to commanders for victories won without the effusion of blood; or for defeating a mean and inconsiderable enemy. The show generally began at the Alban mountain, whence the general with his

retinue

retinue made his entry into the city on foot, with many flutes or pipes sounding in concert as he passed along, and wearing a garland or myrtle as a token of peace. The term *ovation*, according to Servius, is derived from *ovis*, a "sheep;" because on this occasion the conqueror sacrificed a sheep, as in a triumph he sacrificed a bull. The senate, knights, and principal plebeians, assisted at the procession; which concluded at the Capitol, where rams were sacrificed to Jupiter. The first ovation was granted to Publius Posthumius, for his victory over the Sabines in the the 253d year of Rome.

OUDE a province of Hindostan Proper, subject to a nabob, whose dominions lie on both sides of the Ganges, occupying the flat country between that river and the northern mountains, as well as the principal part of that fertile tract, lying between the Ganges and Jumna, to within 40 miles of the city Delhi Oude is about 250 miles in length, by 100 miles in breadth. It is flat, well watered, and fertile in wheat, barley, rice, sugar-canes, indigo, and poppies. The inhabitants are tall, strong, and warlike. Since 1765, a British force has been stationed in the nabob's territories, and paid by him. But from the disorderly state of the nabob's government and finances, it was thought proper, in 1801, to put a great part of the country under the immediate government of the Company, and to relieve the nabob from all pecuniary claims. The gross revenue of the districts ceded, amounted to 13,523,474 Sicca rupees. Oude is also the name of a large town in this province. Lucknow is the capital.

OUDENARDE, a rich and strong town, in the kingdom of the Netherlands, in the province of Flanders, in E. Long. 3. 30. N. Lat. 50. 54. fifteen miles south of Ghent, and eighteen from Tournay. It is a large well fortified town, having a very considerable fort in the middle of it, situated on the river Scheldt, which divides it into two parts. It is almost encompassed by meadows, only there is a hill which commands it on the south side. The buildings are pretty good, the streets wide and handsome, and it contained 4000 inhabitants in 1800. The market-place is adorned with a beautiful town-house, and a fine large fountain. There are several good churches and monasteries well worthy of the notice of travellers. The town has a trade in fine linen and tapestry, and is the capital of a castellany, which contains 33 villages. The French laid siege to it in 1708, which brought on an obstinate engagement, wherein they were defeated by the allies under the command of the duke of Marlborough. It was taken by the French in 1794, and remained under their power till 1814.

OVEN, a kind of domestic furnace, used for baking bread, pies, tarts, &c. of a circular structure, with a very low roof, well lined, both on the top, bottom, and sides, with stone; it has a small entrance in the front, fitted with a door, which being clapped to the mouth of the oven confines the heat, while bread, pies, or puddings, are baking. Over this, pastry cooks have another oven built much in the same manner, which is used for such things as require a less degree of heat. Ovens are heated by burning dry wood, faggots, &c. in them, till all the parts are equally hot.

OVERALL, JOHN, a celebrated English bishop, was born in 1559; and, after a proper foundation in grammar learning, was sent to St John's college, Cambridge, and was elected a scholar of that society: but afterwards removing to Trinity, was chosen fellow of that college. In 1596 he was made regius professor of divinity, when he took the degree of D. D. and about the same time was elected master of Catherine-hall. In 1601 he was raised to the deanery of St Paul's, London, by the recommendation of his patron Sir Fulk Greville, and Queen Elizabeth; and in the beginning of King James's reign, he was chosen prolocutor of the lower house of convocation. In 1612 he was appointed one of the first governors of the Charter-house hospital, then just founded by Thomas Sutton, Esq. In April 1614 he was made bishop of Litchfield and Coventry; and in 1618 he was translated to Norwich, where he died in May 1619, aged, as it is reported, 60 years. He was buried in that cathedral, where he lay unnoticed and forgotten till some time after the restoration of Charles II. when Cosin, bishop of Durham, who had been his secretary, erected a monument in 1669, with a Latin inscription, in which he is said to be, "Vir undequaque doctissimus, et omni incomio major."

Wood observes, that he had the character of being the best scholastic divine in England; and Cosin, who perhaps may be thought to rival him in that sort of learning, calls himself his scholar, and absolutely says that he derived all his knowledge from him. He is also celebrated by Smith for his distinguished wisdom, erudition, and piety. In the controversy which in his time divided the reformed churches about predestination and grace, he held a middle opinion, inclining perhaps to Arminianism. He seems indeed to have paved the way for the reception of that doctrine in England, where it was generally embraced a few years afterwards, chiefly by the authority and influence of Archbishop Laud. Overall cultivated a particular friendship with Gerard Vossius and Grotius; and was much grieved to see the love of peace, and the projects of this last great man to obtain it, so ill repaid. He laboured heartily himself to settle the differences in Holland, upon what is known by the name of the *Quinquarticular controversy*; as appears in part by his letters to the two learned correspondents just mentioned, some of which are printed in the *Epistolæ præstantium virorum*, &c.

The bishop is known in England chiefly by his *Convocation Book*, of which Bishop Burnet gives the following account: "This book was wrote on the subject of government, the divine institution of which was very positively asserted. It was read in convocation, and passed by that body, in order to the publishing of it; in opposition to the principles laid down in the famous book of Parsons the Jesuit, published under the name of *Doleman*. But King James did not like a convocation entering into such a theory of politics; so he discouraged the printing of it, especially since, in order to justify the owning of the United Provinces, who had lately thrown off the Spanish yoke, to be a lawful government, it was laid down, that when a change of government was brought to a thorough settlement, it was then to be owned and submitted to as a work of the providence of God. Here it slept, till Archbishop Sancroft, who had got the book into his own hands, and not observing the last-mentioned passage in it, resolved to publish it in the beginning of King William's reign, as an authentic declaration the church of England had made in the

point

point of non-resistance. Accordingly it was published in 4to, as well as licensed, by him, a very few days before he was under suspension for not taking the oaths.

OVERBURY, Sir Thomas, a learned Englishman, was born in 1581; and studied at Queen's college, Oxford, after which he removed to the Middle-Temple, London. He afterwards travelled for some time, and returned a most accomplished person; when he contracted an intimate acquaintance with Sir Robert Carr, knight of the Bath, who being soon after taken into his majesty's favour, had Mr Overbury knighted at Greenwich. Sir Thomas perceiving the familiarity which subsisted between his patron Carr, now made Viscount Rochester, and the lady Frances, the wife of Robert earl of Essex, was so much displeased at it, that he endeavoured to dissuade him from keeping her company, and from proceeding in the base design he had formed of having her first divorced from her husband, and then marrying her. The viscount, resenting this honest advice, told what he had said to the lady, who was as remarkable for her wickedness as for her beauty; on which they immediately resolved on his destruction. About this time, the king wanting to send an ambassador abroad, the viscount recommended Sir Thomas Overbury. His majesty approving the choice, the viscount imparted the king's intentions to Sir Thomas; but, under a treacherous show of friendship, dissuaded him from accepting of that employment, as it might hinder him from a better way of advancement; promising that he would prevent his majesty from being displeased at his refusal. The viscount then went to the king, and artfully incensing his majesty against Sir Thomas for refusing to obey his commands, that gentleman was committed to the Tower for his contempt, on the 21st of April 1613, where he continued till he was despatched by poison on the 15th of September following, and his body was interred in the Tower-chapel the same day. About two years after, the whole contrivance of his death was discovered. On this several persons were condemned and executed; but though Carr, earl of Somerset, and the lady Frances his countess, were condemned to death for contriving the murder, and hiring the persons who were concerned in it, the king only banished them from court, and afterwards pardoned them. Sir Thomas Overbury wrote several poems, &c. and an account of his travels.

His character is represented by a historian of those times; who, after relating the occasion and circumstances of his death, proceeds in the following terms: "In this manner fell Sir Thomas Overbury, worthy of a longer life and a better fate; and, if I may compare private men with princes, like Germanicus Cæsar, both by poison procured by the malice of a woman, both about the 33d year of their age, and both celebrated for their skill and judgment in poetry, their learning, and their wisdom. Overbury was a gentleman of an ancient family, but had some blemishes charged upon his character, either through a too great ambition, or the insolence of a haughty temper.—— After the return from his travels, the viscount Rochester embraced him with so entire a friendship, that exercising by his majesty's special favour the office of secretary provisionally, he not only communicated to Sir Thomas the secrets, but many times gave him the packets and letters unopened, before they had been perused by the king himself: which as it prevailed too much upon his early years, so as to make him, in the opinion of some, thought high and ambitious; yet he was so far from violating his trust and confidence, that he remains now one example among others who have suffered in their persons or their fortunes for a freedom of advice, which none but sincere friends will give, and which many are such ill friends to themselves as not to receive."

OVER-hauling, the act of opening and extending the several parts of a tackle, or other assemblage of ropes, communicating with blocks or dead eyes. It is used to remove those blocks to a sufficient distance from each other, that they may be again placed in a state of action, so as to produce the effect required.

Over-Hauling, is also vulgarly expressed of an examination or inspection into the condition of a person or thing.

Over-Rake, among seamen: When a ship riding at anchor so overbeats herself into a high sea, that she is washed by the waves breaking in upon her, they say the waves over-rake her.

OVERSMAN, in *Scots Law*, a person appointed by arbiters, or by the parties submitters, to determine the matter submitted, in case the arbiters disagree in their opinion.

OVERT, the same with Open: Thus an overt act signifies an act which, in law, must be clearly proved; and such is to be alleged in every indictment for high treason.

OVERTURE, or Ouverture, opening or preluding: a term used for the solemnities at the beginning of a public act or ceremony; an opera, tragedy, comedy, concert of music, &c. The overture of the theatre or scene, is a piece of music usually ending with a fugue: the overture of a jubilee is a general procession, &c.

OVERYSSEL, one of the Seven United Provinces, so named from its situation beyond the river Yssel, bounded on the east by the bishopric of Munster, on the north by Friesland and the territory of Groningen, on the west by the river Yssel, and on the south by the county of Zutphen and the bishopric of Munster. It is divided into three distinct parts; which are the territories of Drense, Twente, and Salland. There are many morasses in this province, and but few inhabitants, in comparison of the rest. Its greatest riches consist in turfs; which are dug up here, and sent to the neighbouring provinces, particularly Holland. It extends near 60 miles in length from north to south, and 40 in breadth from east to west. The whole country is low and marshy, but it produces a tolerable quantity of corn. It was formerly a dependence of the bishopric of Utrecht, before Henry of Bavaria, bishop of that see, transferred the sovereignty of it to the emperor Charles V.

OVIEDA, a genus of the angiospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 40th order, *Personatæ*. See Botany *Index*.

OVIEDO, a town of Spain, and capital of Asturias d'Oviedo, with a bishop's see, and an university; and containing about 7500 inhabitants. It is seated at the

the confluence of the rivers Ove and Deva, which form the Asta, 50 miles north-west of Leon, and 208 north-west of Madrid. W. Long. 5. 47. N. Lat. 43. 23.

OUGHTRED, William, an eminent mathematician, was born at Eton in 1573, and educated in the school there, whence he was elected to King's-college in Cambridge, of which he afterwards became fellow. Being admitted to holy orders, he left the university about the year 1603, and was presented to the rectory of Aldbury, near Guildford in Surry; and about the year 1628 was appointed by the earl of Arundel to instruct his son in the mathematics. He kept a correspondence by letters with some of the most eminent scholars of his time upon mathematical subjects; and the most celebrated mathematicians of that age owed most of their skill to him, whose house was full of young gentlemen that came from all parts to receive his instruction. It is said that, upon hearing the news of the vote at Westminster for the restoration of King Charles II. he expired in a sudden transport of joy, aged 88. He wrote, 1. *Clavis Mathematica;* which was afterwards published in England. 2. A description of the double horizontal dial. 3. *Opuscula Mathematica;* and several other works. He left also behind him a great number of papers upon mathematical subjects, which are now in the museum of William Jones, Esq. F. R. S.

David Lloyd, in his Memoirs, has given the following short character of him: "That he was as facetious in Greek and Latin, as solid in arithmetic, geometry, and the sphere of all measures, music, &c. exact in his style as in his judgment; handling his tube and other instruments at 80 as steadily as others did at 30; owing this, as he said, to temperance and archery; principling his people with plain and solid truths, as he did the world with great and useful arts; advancing new inventions in all things but religion, which, in its old order and decency, he maintained secure in his privacy, prudence, meekness, simplicity, resolution, patience, and contentment." He had one son; whom he put an apprentice to a watchmaker, and wrote a book of instructions in that art for his use.

OVID, or *Publius Ovidius Naso*, a celebrated Latin poet of the Augustan age, was a Roman knight, born at Sulmo, in the 43d year before the Christian era. He studied rhetoric under Aurelius Fuscus, and for some time frequented the bar. His progress in the study of eloquence was great, but the father's expectations were frustrated; his son was born a poet, and nothing could deter him from pursuing his natural inclination to write poetry, though he was often reminded that Homer lived and died in the greatest poverty. Every thing he wrote was expressed in poetical numbers, as he himself says, *Et quod tentabam scribere versus erat.* A lively genius and a fertile imagination soon gained him admirers; the learned became his friends: Virgil, Propertius, Tibullus, and Horace, honoured him with their correspondence, and Augustus patronized him with the most unbounded liberality. These favours, however, were but momentary; for after having obtained the esteem of Augustus, he incurred his displeasure, and was banished to Tomos, a city on the Pontus Euxinus, near the mouth of the Danube, when he was 5· years of age. The true cause of this sudden exile is unknown. Some attribute it to a shameful amour with Livia the wife of Augustus, while others suppose that it arose from the knowledge which Ovid had of the unpardonable incest of the emperor with his daughter Julia. These reasons are indeed merely conjectural; the cause was of a very private and very secret nature, of which Ovid himself is afraid to speak. It was, however, something improper in the family and court of Augustus, as these lines seem to indicate:

Cur aliquid vidi? Cur noxia lumina feci?
Cur imprudenti cognita culpa mihi est?
Inscius Actæon vidit sine veste Dianam,
Præda fuit canibus non minus ille suis.

Again,

Inscia quod crimen viderunt lumina plector,
Peccatumque oculos est habuisse meum.

And in another place,

Perdiderunt cum me duo crimina, carmen et error,
Alterius facti culpa silenda mihi est.

In his banishment, Ovid betrayed his pusillanimity in a great degree; and however affecting and distressed his situation was, yet the flattery and impatience which he showed in his writings are a disgrace to his pen, and lay him more open to ridicule than to pity. Though he prostituted his pen and his time to adulation, yet the emperor proved deaf to all entreaties, and refused to listen to his most ardent friends at Rome who wished for his return. Ovid, who really wished for a Brutus to deliver Rome of her tyrannical Augustus, still continued his flattery even to meanness; and when the emperor died, he was so mercenary as to consecrate a small temple to the departed tyrant on the shore of the Euxine, where he regularly offered frankincense every morning. Tiberius proved as regardless as his predecessor to the entreaties which were made for the poet, and he died in the seventh or eighth year of his banishment, in the 57th year of his age. He was buried at Tomos. In the year 1508 of the Christian era, the following epitaph was discovered at Stain, in the modern kingdom of Austria.

Hic situs est vates quem Divi Cæsaris ira,
Augusti patria cedere jussit humo.
Sæpe miser voluit patriis occumbere terris,
Sed frustra! hunc illi fata dedere locum.

This, however, is an imposition to render celebrated an obscure corner of the world, which never contained the bones of Ovid. The greatest part of his poems are remaining. His *Metamorphoses*, in 15 books, are extremely curious, on account of the great variety of mythological facts and traditions which they relate, but they can have no claim to epic honours. In composing this the poet was more indebted to the existing traditions, and to the theogony of the ancients, than the powers of his own imagination. His *Fastia* were divided into 12 books, like the constellations in the zodiac, but of these six are lost; and the learned world have reason to lament the loss of a poem which must have thrown so much light upon the religious rites and ceremonies, festivals and sacrifices, of the ancient Romans, as we may judge from the six that have survived the ravages of time and barbarity. His *Tristia*,

tia, which are divided into five books, contain much elegance and softness of expression; as also his *Elegies* on different subjects. The *Heroides* are nervous, spirited, and diffuse; the poetry is excellent, the language varied, but the expressions are often too wanton and indelicate; a fault which is very common with him. His three books *Amorum*, and the same number *de Arte Amandi*, with the other *de Remedio Amoris*, are written with peculiar elegance, and contain many flowery descriptions; but the doctrine which they hold forth is dangerous, and they are to be read with caution, as they seem to be calculated to corrupt the heart, and to sap the very foundations of virtue and morality. His *Ibis*, which is written in imitation of a poem of Callimachus of the same name, is a satirical performance. Besides these, there are extant some fragments of other poems, and among these part of a tragedy called *Medea*. The talents of Ovid as a dramatic writer have been disputed, and some have remarked that he who is so often void of sentiment was not born to shine as a tragedian. He has attempted, perhaps, too many sorts of poetry at once. On whatever he has written, he has totally exhausted the subject. He everywhere paints nature with a masterly hand, and adds strength even to vulgar expressions. It has been judiciously observed, that his poetry after his banishment from Rome was destitute of that spirit and vivacity which we admire in those which were written before. His *Fasti* are perhaps the best written of all his poems; and after them we may fairly rank his love verses, his *Heroides*, and after all his *Metamorphoses*, which were not totally finished when Augustus banished him. His *Epistles from Pontus* are the language of a weak and sordid flatterer. However critics may have cause to censure the indelicacy and the inaccuracies of Ovid, it is to be acknowledged that his poetry contains great sweetness and elegance, and like that of Tibullus, charms the ear and captivates the mind.—Another person of the name of OVID accompanied his friend Cæsonius when banished from Rome by Nero.

OVIEDO, JOHN GONSALVEZ DE, born at Madrid about the year 1478, was educated among the pages of Ferdinand king of Arragon and Isabella queen of Castile; and happened to be at Barcelona in 1493, when Christopher Columbus returned from his first voyage to the island Haiti, which he called Hispaniola, and which now goes by the name of St Domingo. He formed an intimate acquaintance with Columbus and his companions, and was at pains to inform himself of every thing relating to the new discoveries. He rendered such essential service to Spain during the war of Naples, that Ferdinand determined to send him to the island of Haiti, as intendant and inspector general of the trade of the New World. The ravages which the venereal disease had made during that war, induced him to inquire into what were the most efficacious remedies for this malady, which was supposed to have come from the West Indies. His inquiries were extended to every thing which regards the natural history of these regions; and, on his return to Spain, he published *Summario de la Historia general y natural de las Indias Occidentales*, which he dedicated to Charles V. He afterwards made some additions to this work, which he published under the title of *La Historia general y natural de las Indias Occidentales*; Salamanca, 1535, folio. It was translated into Italian, and afterwards into French; Paris, 1556, folio. In this work, Oviedo says that the French pox is endemical in the island of Haiti, and that it has passed from thence into Europe. He greatly extols the use of the wood of guaiacum for the cure of this disease; but whether the disease is now become more obstinate, or the remedy does not possess that efficacy which is ascribed to it, it is at present in little estimation.

OVILIA, or SEPTA, in ancient Rome, a place in the Campus Martius, at first railed in like a sheep-pen, whence its name. Afterwards it was mounted with marble, and beautified with walks and galleries, as also with a tribunal or seat of justice. Within this precinct or inclosure the people were called to give their suffrages for the election of magistrates. The ascent into the ovilia was not by stairs, but by pontes, or narrow boards, laid there for the occasion; on which account, *de ponte dejici* signified "to be deprived of the privilege of voting;" and persons thus dealt with were called *depontani*.

OVIPAROUS, a term applied to such animals as bring forth their young from eggs; as birds, insects, &c.

OVIS, the SHEEP, a genus of the mammalia class, and of the order of *Pecora*. See MAMMALIA *Index*.

OUNCE, a weight, the 16th part of a pound avoirdupois, and the 12th part of a pound troy. The word is derived from the Latin, *uncia*, "the twelfth part of any whole," called *as*; particularly in geometrical measures, an inch, or 12th part of a foot. See INCH and AS.

OUNCE. See FELIS, MAMMALIA *Index*.

OVOLO, or OVUM, in *Architecture*, a round moulding, whose profile or sweep, in the Ionic and Composite capitals, is usually a quadrant of a circle: whence it is also commonly called the *quarter-round*. It is usually cut with representations of eggs and arrow-heads or anchors placed alternately.

OU-POEY-TSE, a name given by the Chinese to a kind of nests made by certain insects upon the leaves and branches of the tree called *yen-fou-tse*. These nests are much used in dyeing, and the physicians employ them for curing many distempers. Some of these nests were brought to Europe, and put into the hands of the celebrated Mr Geoffroy. After having examined them with the utmost attention, this learned academician thought he perceived some conformity in them to those excrescences which grow on the leaves of the elm, and which the vulgar call *elm-bladders*: he found these nests so sharp and astringent to the taste, that he considered them as far superior to every other species of galls used by the dyers. According to him, they are the strongest astringents existing in the vegetable kingdom.

It is certain that there is a great affinity between the ou-poey-tse and the elm-bladders. The form of both is unequal and irregular; they are covered on the outside with a short down, which renders them soft to the touch; within they are full of a whitish-gray dust, in which may be observed the dried remains of small insects, without discovering any aperture through which they might have passed. These nests or bladders harden as they grow old; and their substance, which appears resinous, becomes brittle and transparent; however, the Chinese do not

not consider the ou-poey-tse, notwithstanding their resemblance to elm-bladders, as excrescences of the tree yen-fou-tse, upon which they are found. They are persuaded, that insects produce a kind of wax, and construct for themselves on the branches and leaves of this tree (the sap of which is proper for their nourishment) little retreats, were they may wait for the time of their metamorphosis, or at least deposit in safety their eggs, which compose that fine dust with which the ou-poey-tse are filled. Some of the ou-poey-tse are as large as one's fist; but these are rare, and are generally produced by a worm of extraordinary strength, or which has associated with another, as two silk worms are sometimes seen shut up in the same ball. The smallest ou-poey-tse are of the size of a chesnut; the greater part of them are round and oblong; but they seldom resemble one another entirely in their exterior configuration. At first, they are of a dark green colour, which afterwards changes to yellow; and the husk, though pretty firm, becomes then very brittle.

The Chinese peasants collect these ou-poey-tse before the first hoar-frost. They take care to kill the worm inclosed in the husks, and to expose them for some time to the steam of boiling water. Without this precaution, the worm might soon break through its weak prison, which would immediately burst and be useless. The ou-poey-tse are used at Pekin for giving paper a durable and deep-black colour; in the provinces of Kiang-nan and Tche-kiang, where a great deal of beautiful satin is made, they are employed for dyeing the silk before it is put on the loom. The Chinese literati also blacken their beards with them when they become white.

The medicinal properties of the ou-poey-tse, are very numerous. The Chinese physicians introduce them into the composition of many of their remedies. They recommend them for stopping bloodings of every kind; they consider them as an excellent specific for curing inflammations and ulcers, and for counteracting the effects of poison; and they employ them with success in the dropsy, phthisis, epilepsy, catarrhs, sickness, fluxions of the eyes and ears, and in many other disorders.

GREATER OUSE, a river which rises near Fitwell in Oxfordshire, and proceeds to Buckingham, Stony-Stratford, and Newport-Pagnel, in Buckinghamshire; from thence it proceeds to Bedford, and turning north-east it passes on to Huntingdon and Ely, till at length it arrives at Lynn-Regis in Norfolk, and falls into the sea. It is navigable to some distance above Downham, where there is a good harbour for barges; and a considerable trade is carried on by it to Lynn and other towns.

Smaller OUSE, rises in Suffolk, and, separating that county from Norfolk on the south-west, discharges itself into the great Ouse near Downham. There is still another of the same name, which rises in the west northwest side of Yorkshire; and chiefly running to the south-east, at length falls into the Humber.

OUSTER, or DISPOSSESSION, in *Law*, an injury which carries with it the amotion of possession; for by means of it the wrong doer gets into the actual possession of the land or hereditament, and obliges him that hath a right to seek a legal remedy, in order to gain possession, together with damages. This ouster may either be of the freehold by abatement, intrusion, disseisin, discontinuance, and deforcement; or of chattels real, as an estate by statute-merchant, statute-staple, or elegit, or an estate for years.

OUSTER le Main, amovere manum, in *Law*, denotes a livery of lands out of the king's hands; or a judgement given for him that traversed, or sued, a *monstrans le droit*. When it appeared, upon the matter being discussed, that the king had no right or title to the land seized, judgment was given in chancery, that the king's hand be amoved; and *ouster le main* or *amoveas manum*, was therefore awarded to the eschator, to restore the land, &c. All wardships, liveries, *ouster le mains*, &c. are now taken away and discharged by statute 12 Car. II.

OUSTIOUG, a town of the Russian empire, and capital of a province of the same name, with an archbishop's see and a castle; seated on the river Suchana, over against the mouth of the Jug, in E. Long. 43. 25. N. Lat. 61. 48.

OUSTIOUG, a province of the Russian empire, bounded on the north by Dwina, on the east by the forest of Zirani, on the south by Wologda, and on the west by Cargapol and Waga. It is divided into two parts by the river Suchana; is full of forests; and the rivers yield plenty of fish, which the inhabitants dry in the sun, and which make their principal nourishment.

OUT-POSTS, in a military sense, a body of men posted beyond the grand-guard, called *out-posts*, as being the rounds or limits of the camp.

OUTLAW, signifies one that is deprived of the benefit of the law, and therefore held to be out of the king's protection.

Bracton asserts, that an outlaw forfeits all he has; and that, from the time of his outlawry, he wears a wolf's head; and anybody may kill him with impunity, especially if he defend himself or fly. But in Edward III.'s time it was resolved by the judges, that it should not be lawful for any man, but the sheriff alone (having sufficient warrant for it), to put to death a man that was outlawed.

OUTLAWRY, the punishment of a person who being called into law, and lawfully, according to the usual forms, sought, does contemptuously refuse to appear.

The effect of being outlawed at the suit of another, in a civil cause, is the forfeiture of all the person's goods and chattels to the king, and the profits of his land, while the outlawry remains in force. If in treason or felony, all the lands and tenements which he has in fee, or for life, and all his goods and chattels, are also forfeited, and besides, the law interprets his absence as a sufficient evidence of guilt; and without requiring farther proof, accounts the person guilty of the fact, on which ensues corruption of blood, &c. And then, according to Bracton, he may perish without law, &c. However, to avoid inhumanity, no man is entitled to kill him wantonly or wilfully; but in so doing he is guilty of murder, unless it happens in endeavouring to apprehend him; for anybody may arrest an outlaw, either of his own head, or by writ or warrant of *capias utlagatum*, in order to bring him to execution.

If after outlawry in civil cases, the defendant publicly appear, he is to be arrested by a writ of *capias utlagatum*, and committed till the outlawry be reversed: which reversal may be had by the defendant's appearing in court (and in the king's-bench, by sending an attorney, according to statute 4 and 5 W. and M. cap. 18.) and

and any plausible circumstance, however trifling, is in general sufficient to reverse it; it being considered only as a process to force appearance. The defendant must, however, pay full costs, and must put the plaintiff in the same condition as if he had appeared before the writ of *exigi facias* was awarded. It is appointed by magna charta, that no freeman shall be outlawed, but according to the law of the land. A minor or a woman cannot be outlawed.

In Scotland outlawry anciently took place in the case of refusal to fulfil a civil obligation, as well as in criminal cases. At present, however, it only takes place in the two cases of flying from a criminal prosecution, and of appearing in court attended by too great a number of followers. But the defender, upon appearing at any distance of time and offering to stand trial, is entitled *de jure* to have the outlawry reversed, and to be admitted to trial accordingly, and even to bail if the offence be bailable. See WAIVE.

OVUM ANGUINUM. See ANGUINUM.

OUTWORKS, in *Fortification*, all those works made without-side the ditch of a fortified place, to cover and defend it. See FORTIFICATION.

OUSEL, a species of MOTACILLA. See ORNITHOLOGY *Index*.

OWEN, THOMAS, a judge of the common-pleas, son of Richard Owen, Esq. of Condover in Shropshire, was educated at Oxford. Having taken a degree in arts, he left the university, and entered himself of Lincoln's inn in London, where in process of time he became an eminent counsellor. In 1583 he was elected Lent-reader to that society. In 1590 he was made sergeant at law, and queen's sergeant soon after. He arrived at length at the dignity of judge of the common-pleas; which office he is said to have executed, during five years, with great abilities and integrity. He died in 1598; and was buried on the south side of the choir in Westminster abbey, where a monument was erected to his memory. He had the reputation of a learned man, and a patron of literature. He was the author of "Reports in the common pleas, wherein are many choice cases, most of them thoroughly argued by the learned sergeants, and after argued and resolved by the grave judges of those times, with many cases wherein the differences of the year-books are reconciled and explained." Lond. 1656, folio.

OWEN, *Dr John*, an eminent and learned dissenting minister, was born in 1616, at Hadham, in Oxfordshire, of which place his father was vicar. He made such surprising proficiency in learning, that at twelve years of age he was admitted into Queen's college, Oxford, and in 1635 was made master of arts: but soon after, disapproving the new regulations made by Archbishop Laud their chancellor, with which he refused to comply, he was obliged, in 1737, to leave the university: when taking orders, he became chaplain to Sir Robert Dormer of Ascot in Oxfordshire, and was at the same time tutor to his eldest son. He was afterwards chaplain to John Lord Lovelace of Hurley in Berkshire. When the civil war broke out, he openly avowed the cause of the parliament; which was so resented by an uncle who had intended to leave him his estate, that he discarded him, and left it to another. Yet though Lord Lovelace joined the king, he treated his chaplain with great civility: but on his taking the field with the royal army, Mr Owen went to London, and soon after joined the non-conformists. In 1642 he published his book, intitled, *A Display of Arminianism*, which laid the foundation of his future advancement: for the committee for purging the church of scandalous ministers were so pleased with it, that Mr White their chairman sent him a presentation of the living of Fordham in Essex: but when he had been there about a year and a half, the patron hearing that the sequestered incumbent was dead, presented another to the living; upon which the earl of Warwick gave Mr Owen the living of Coggeshal. He had not, however, been long at that town before he left the Presbyterians; and, joining the Independents, formed a church there. He was now sent for several times to preach before the parliament; and among the rest on the 28th of February 1648-9, the day of humiliation for the intended expedition to Ireland. Cromwell, who was present at this last discourse, and had never heard him before, was extremely pleased with it, and desired his company into Ireland, and that he would reside in the college of Dublin. This he did; but returned in about half a year. Soon after Cromwell sent him into Scotland; but he also returned from thence after about half a year's stay at Edinburgh. He was then promoted to the deanery of Christ-church, Oxford, whither he went in 1651; and Cromwell, being now chancellor of the university, nominated him his vice-chancellor. The next year he was created doctor of divinity by diploma. Dr Owen enjoyed the post of vice-chancellor five years; during which he behaved with the greatest moderation; for, though often solicited, he never molested the meeting of the royalists at the house of Dr Willis the physician, where divine service was performed according to the liturgy of the church of England: and though he was a commissioner for ejecting scandalous ministers, he frequently overruled his brethren in favour of those royalists who were distinguished by their merit. At the death of Cromwell, he was removed from the vice-chancellorship; and at the Restoration was ejected from his deanery of Christ-church. But he had provided himself a comfortable retreat at an estate he had purchased at Hadham. He now employed himself in preaching as often as he had an opportunity, and in writing books; one of which, intitled *Fiat Lux*, falling into the hands of Lord Clarendon, he was so pleased with it, or (as is said) from policy pretended to be so, that he sent for Dr Owen, and acknowledging the service he had done by it to the Protestant religion, offered to prefer him in the church if he would conform; but he desired to be excused.—His moderation drew him respect from persons of opposite principles; and in the number of his friends were Dr Wilkins bishop of Chester, and Dr Barlow bishop of London. He died at Ealing in 1683. His works are printed in seven volumes folio.

Wood, after censuring him in many respects, says nevertheless, that, "to speak impartially, he was a person well skilled in the tongues, Rabbinical learning, and Jewish rites and customs; that he had a great command of his English pen, and was one of the genteelest and fairest writers who have appeared against the church of England."

OWHYHEE, the easternmost, and by far the largest, of the Sandwich islands. Its greatest length from north to south is $28\frac{1}{2}$ leagues, its breadth 24, and its circumference

Owhyhee. circumference nearly 300 English miles. It is divided into six large districts; two of which on the north-east side are separated by a mountain, that rises in three peaks, which is perpetually covered with snow, and may be seen clearly at 40 leagues distance. To the north of this mountain, the coast consists of high and steep cliffs, down which fall many beautiful cascades of water. The whole country is covered with cocoa-nut and bread-fruit trees. The peaks of the mountain on the north-east side appear to be about half a mile in height, and entirely covered with snow. To the south of this mountain, the coast presents a prospect of the most dreary kind, the whole country appearing to have undergone a total change by means of some dreadful convulsion. The ground is everywhere covered with cinders, and intersected in many places with black streaks, which seem to mark the course of a lava that has flowed not many ages since from the mountain to the shore. The southern promontory looks like the mere dregs of a volcano. The projecting headland is composed of broken and craggy rocks, piled irregularly one upon another, and terminating in sharp points; yet amidst these ruins, there are many pieces of rich soil, which are carefully laid out in plantations, and the neighbouring sea affords a vast variety of excellent fish: so that this quarter is much better inhabited than those which are more verdant. The fields are inclosed with stone fences, and are interspersed with groves of cocoa nut trees. We are told indeed by some of Cook's people who walked through a considerable part of it, that they did not observe a spot of ground, that was susceptible of improvement left unplanted; and indeed the country, from their account, could scarcely be cultivated to greater advantage for the purposes of the natives. They were surprised at seeing several fields of hay; and upon their inquiry, to what particular use it was applied, they were informed, that it was intended to cover the grounds where the young *taro* grew, in order to preserve them from being scorched by the rays of the sun. They observed among the plantations a few huts scattered about, which afforded occasional shelter to the labourers; but they did not see any villages at a greater distance from the sea than four or five miles. Near one of them, which was situated about four miles from the bay, they discovered a cave forty fathoms in length, three in breadth, and of the same height. It was open at each end; its sides were fluted as if wrought with a chisel; and the surface was glazed over, perhaps by the action of fire. There are supposed to be on this island about 150,000 inhabitants. So long as the name of Captain Cook shall be remembered, this island will not be forgotten; for he here fell a victim to a strange concatenation of events. See COOK.

We have the following account of the inhabitants of this island in Ellis's Authentic Narrative, &c. "The men are above the middle size, stout, well made, and fleshy, but not fat. Corpulency is not altogether so great a mark of distinction in these as in the Society isles; and tallness, for which the Otaheiteans have great partiality, is also overlooked. Their colour is in general brown olive. The women are in general masculine, though there are some delicately made, and the voice of them all is soft and feminine. The hair both of the head and beard is black; that of the head the men wear in the form of a helmet, that is, a long frizzled ridge from the forehead to the neck, the sides being much shorter. This fashion seems to prevail only among the principal people, that of the inferior sort being of an equal length in every part. Most of them were very desirous of parting with their beards, which, they said, were disagreeable and troublesome, and were fond of being shaved by our people. Some of the priests wore their beards long, and would not on any account part with them. The women wear their hair long before, but very short behind, which is not the most becoming mode; and, like those of the Friendly isles, they have a way of rendering it of different colours, red, yellow, and brown. The features of both sexes are good, and we saw some of the females who might really be called fine women. Their teeth are even, and perfectly white. In general, they seem to be very healthy, and we observed several who appeared to be of great age. As to diseases we saw none who laboured under any during our stay, except the venereal complaint; coughs and colds indeed were pretty general, and one man died. From what we could learn of his disorder from the natives, it was a violent griping or colic.

"Both men and women appeared to be of a good disposition, and behaved to each other with the tenderest regard: when they did fall out, which sometimes was the case, occasioned by the upsetting of a canoe, or some such trifling accident, they only scolded a little, and this was soon over and forgotten. We never saw them strike each other upon any occasion. They are all thieves, from the aree to the towto, but not quite so expert at it as our Otaheite friends.

"The custom of tattowing prevails greatly among these people, but the men have a much larger share of it than the women; many (particularly some of the natives of Mow'whee) have one half of their body, from head to foot, marked in this manner, which gives them a most striking appearance. It is done with great regularity, and looks remarkably neat: some have only an arm marked in this manner, others a leg; some again have both arm and leg, and others only the hand. The women are for the most part marked upon the tip of their tongue; but of these we saw but few. Both sexes have a particular mark according to the district in which they live; or it is rather the mark of the aree, or principal man, under whose jurisdiction they more immediately are. We never saw the operation of tattowing performed, nor could we procure a sight of the instruments used upon this occasion; but it is likely they are much the same as those of the Friendly and Society isles.

"Both men and women are very cleanly in their persons; the latter wash their whole bodies in fresh water twice and sometimes three times a-day; but the women of Otaheite have the advantage of them in one point of cleanliness, which is eradicating the hairs from under the arm-pits. This is a custom we observed nowhere but at the Society isles.

"There are no people in the world who indulge themselves more in their sensual appetite than these: in fact, they carry it to a most scandalous and shameful degree, and in a manner not proper to be mentioned. The ladies are very lavish of their favours; but are far from being so mercenary as those of the Friendly or Society isles, and some of their attachments seemed purely the effect

effect of affection. They are initiated into this way of life at a very early period; we saw some who could not be more than ten years old.

"Their clothing consists of cloth of different kinds; that worn by the men, which is called *marro*, is about half a yard wide, and four yards long; that of the women three quarters of a yard wide, and of the same length as the men's: this they call *pah-òouwa*; they both wear it round their middle, but the men pass it between their legs. This is the general dress of both sexes; but the better sort sometimes throw a large piece loosely over their shoulders. Besides the marro, they have several other kinds of cloth, which derive their names either from the different uses they are applied to, or their different texture and pattern; all, however, as far as we could learn, are made from the Chinese paper mulberry tree. The principal of these is the cappa, which is about 10 or 12 feet long, and nearly as many wide, and is thick and warm; they wrap themselves up in this when they retire to sleep. They have another kind, which is white, and much thinner; this, as has been before observed, they throw loosely over their shoulder; it is sometimes 20 or 30 yards long, and wide in proportion. The marro and pah òouwa are curiously painted of various patterns, but the others are generally white, or dyed red, black, and yellow.

"The principal ornaments of the men are the feather caps and cloaks; some of the latter reach down to their heels, and have a most magnificent appearance. They are made for the most part of red and yellow feathers, which are tied upon fine net-work. The caps are composed of the same kind of feathers, which are sometimes intermixed with black; they are secured upon a kind of basket-work, made in the form of a helmet. Both caps and clocks are made of various patterns and sizes. The cloaks are not all composed of the same kind of feathers, but are sometimes varied with the long tail feathers of the cock, with a border of yellow or red, and sometimes with those of the tropic bird. Both caps and cloaks, however, are only to be seen in the possession of the principal people. They have also a kind of fly-flap, made of a bunch of feathers fixed to the end of a thin piece of smooth and polished wood: they are generally made of the tail feathers of the cock, but the better sort of people have them of the tropic bird's feathers, or those belonging to a black and yellow bird called *mohó*. The handle is very frequently made of one of the bones of the arms or legs of those whom they have killed in battle, curiously inlaid with tortoise-shell: these they deem very valuable, and will not part with them under a great price. This ornament is common to the superiors of both sexes.

"The women too have their share in the ornamental way: that which they value most is the orai. This is a kind of ruff or necklace, made of red, green, black, and yellow feathers, curiously put together, and in most elegant patterns, which really do honour to the fancy of the ladies, whose business it is to make them. They never think themselves dressed without one or two of these round their necks, and those who can afford it wear many. Others again are composed of small variegated shells, disposed in a very neat manner; and some consist of several rows of twisted hair, with a piece of carved wood or bone, highly polished, the bottom part forming a curve. The higher the quality of the wearer, the greater is the size of the wood or bone, and the quantity of the twisted hair. The next thing is the poo-remah or bracelet; the most valuable are made of bear's tusks fastened together side by side with a piece of string, by means of a hole drilled through the middle; the larger the tusks, the greater the value. Sometimes two shells tied round the wrists with twisted or braided hair, serve the purpose of bracelets; but even in this case they show great nicety, being particularly careful to match them as near as possible. They were prodigiously fond of those we gave them, which were only a few beads, secured by thread upon a strip of scarlet cloth, and made to button round the wrist. So much did they at first value them, that a small hatchet and one of these would purchase a hog, which without it could not have been bought for three large hatchets. The women were perpetually teazing the men to dispose of their various articles for these bracelets; at least one of them was always to make a part of the price." W. Long. 156. 0. N. Lat. 19. 28.

OWL. See Strix, Ornithology *Index*.

OWLING, so called from its being usually carried on in the night, is the offence of transporting wool or sheep out of this kingdom, to the detriment of its staple manufacture. This was forbidden at common law, and more particularly by statute 11 Edw. III. c. 1. when the importance of our woollen manufacture was first attended to; and there are now many later statutes relating to this offence, the most useful and principal of which are those enacted in the reign of Queen Elizabeth and since. The statute 8 Eliz. c. 3. makes the transportation of live sheep, or embarking them on board any ship, for the first offence forfeiture of goods, and imprisonment for a year, and that at the end of the year the left hand shall be cut off in some public market, and shall be there nailed up in the openest place; and the second offence is felony. The statutes 12 Car. II. c. 32. and 7 and 8 Will. III. c. 28. make the exportation of wool, sheep, or fullers earth, liable to pecuniary penalties, and the forfeiture of the interest of the ship and cargo by the owners, if privy; and confiscation of goods, and three years imprisonment to the master and all the mariners. And the statute 4 Geo. I. c. 11. (amended and farther enforced by 12 Geo. II. c. 21. and 19 Geo. II. c. 34.), makes it transportation for seven years, if the penalties be not paid.

OXALIS, Woodsorrel, a genus of plants belonging to the decandria class, and in the natural method ranking under the 14th order, *Gruinales*. See Botany *Index*.

OXFORD, the capital of a county of the same name in England, celebrated for its university, and pleasantly situated in a plain, in the middle of a fine fruitful country. The composition of the name is obvious. In the British times it seems to have been a place of study. "The wisdom of our ancestors (says Camden) as appears in our history, consecrated even in the British times this city to the muses, translating them from Greeklade (now a small town in Wilts) hither, as to a more fruitful nursery. For Alexander Necham* writes, "Italy claims superior knowledge of civil law; but the study of

* *De Natura Rerum*, lib. ii.

Oxford. of divinity and the liberal arts proves, that the university of Paris deserves the preference to all others. Agreeable also to Merlin's prophecy, Wisdom has flourished at the Ford of Oxen, and will in its due time pass over also into Ireland." But in the following Saxon age, when so many cities were destroyed, it underwent the common fate, and for a long while was famous only for the relicks of Frideswide, who was ranked among the saints for her holy life, merely because she had solemnly devoted herself to God; and Prince Algar, soliciting her in marriage, was miraculously, as they say, deprived of his eye-sight."

Perhaps the following additional extract from Camden will be more to the purpose in developing the ancient state of learning in this city, than any thing which we could bring forward of our own. "When the storm of the Danish war was over, the most religious Prince Alfred † restored their retreats to the long-exiled muses, by founding three colleges, one for grammarians, another for philosophy, and a third for divinity. This will be more fully explained by the following passage in the old annals of the New Monastery at Winchester. 'In the year of our Lord 806, the second year of the arrival of St Grimbald in England, the university of Oxford was begun; the first who presided and read divinity lectures in it being St Neoth, an abbot and able divine, and St Grimbald, a most eminent professor of the incomparable sweetness of the sacred pages; Asser the monk, an excellent scholar, professing grammar and rhetoric; John monk of the church of St David giving lectures in logic, music, and arithmetic; and John the monk, colleague of St Grimbald, a man of great parts, and an universal scholar, teaching geometry and astronomy before the most glorious and invincible King Alfred, whose memory will dwell like honey in the mouths of all." Soon after, as we find in an excellent MS. of the said Asser, who was at that time professor here, 'broke out a sharp and fatal quarrel between Grymbold and those very learned men whom he had brought thither with him, and the old scholars whom he found there; who, on his coming, unanimously refused to receive the rules, methods, and forms of lecturing, that Grymbold introduced. Three years had passed without any great difference between them; but the secret aversion afterwards broke out with the utmost violence. In order to quell it, the invincible King Alfred, as soon as he heard of it by the messages and complaints from Grymbold, went in person to Oxford to put an end to the dispute, and he took the greatest pains to hear the causes and complaints on both sides. The foundation of the difference was this: The old scholars maintained, that before Grymbold came to Oxford, learning had flourished there, though the scholars at that time were fewer than in more ancient times, the greater part being driven out by the cruelty and oppression of the Pagans. They also proved and showed, and that by the undoubted testimony of ancient chronicles, that the ordinances and regulations of the place were established by certain religious and learned men, such as Gildas, Melkinnus, Ninnius, Kentigern, and others, who had all lived to a good old age in these studies, having settled matters there in peace and harmony; and also that St Germanus came to Oxford, and staid there half a year in his journey over Britain to preach against the Pelagian heresies, and wonderfully approved their plan and institution. The king, with unheard-of condescension, gave both parties attentive hearing, and repeated his pious and seasonable advice to maintain mutual union and concord, and left them with the prospect that both parties would follow his advice and embrace his institutions. But Grymbold, offended at this proceeding, immediately retired to the monastery at Winchester lately found by King Alfred. He also caused his tomb to be removed to Winchester, in which he had intended to lay his bones when his course of life was ended, in the vault under the chancel of St Peter's church at Oxford, which church himself had built from the ground, of stone polished in the most costly manner.'

† A.D. 866.

"This happy restoration of learning was followed in a few years by various calamities. The Danes in the reign of Edward plundered and burnt the place; and soon after Harold Harefoot practised the most inhuman barbarities here in revenge for some of his men who were killed in an affray; so that the most melancholy remove of the students ensued, and the university remained almost extinct, a lamentable spectacle, till the time of William the Norman. Some have falsely supposed this prince took the city, misled by a wrong reading in some copies of *Oxonia* for *Exonia*. At that time, however, it was the seat of an university, as we learn from these words of Ingulphus, who lived at that time. 'I Ingulphus settled first at Westminster, was afterwards sent to study at Oxford, having made greater proficiency than many of my own age in Aristotle, &c.' What we call an *university*, they in that age called a *study*." Many are of opinion that it was deserted till about the year 1129, and that this desertion was in consequence of its having been besieged and taken by William the Conqueror. About this year, however, Robert Pulen began to read lectures in divinity, or (as it is expressed in the chronicle of Oseney abbey) the Holy Scriptures, which had fallen into neglect in England; and such was the resort of students to it, that in the reign of King John there were not fewer than 3000. Robert d'Oily, a Norman, to whom William the Conqueror had given the greatest part of it, built a castle on the west side, in 1071; and he is also supposed to have surrounded it with walls. In a palace built by Henry I. was born Richard I. commonly called *Cœur de Lion*. About the tenth of King John, there happened a quarrel between the citizens and students; in consequence of which many of the latter quitted it, but returned again a few years afterwards. Here Henry III. held a parliament to settle the difference between him and his barons; when he confirmed the privileges granted to the university by his predecessors, and added others of his own. In this reign the students are said to have been 30,000, who were all excommunicated by the pope for some rudeness to his legate. In the time of Duns Scotus, we are told that 30,000 scholars attended his lectures. Matthew Paris styles the university of Oxford, 'the second school of the church after Paris, and the very foundation of the church.' The popes had before this honoured it with the title of *University*, which they had conferred by their degrees on no other but that of Paris, this of Oxford, and those of Bologna and Salamanca. It was decreed in the council of Vi-enne,

enne, that 'schools for the study of the Hebrew, Arabic, and Chaldee languages, should be erected in the studies of Paris, Oxford, Bologna, and Salamanca (as the most considerable), that the knowledge of these languages might prevail by their being thus taught; and that Catholic persons be chosen, sufficiently versed therein, two in each language. For those in Oxford, the bishops, monasteries, chapters, convents, colleges, exempt and not exempt, and the rectors of churches throughout England, Scotland, Ireland, and Wales, were to provide a competent maintenance." In Edw. III.'s time, the scholars were split into two factions, called the *northern* and *southern men;* a division which was attended with many disorders and much violence, but in a short time concord and harmony again prevailed.

As colleges began about this time to be founded and endowed, we shall here present our readers with a list of them, together with the time when, and the persons by whom, they were founded.

Colleges.	*Founders.*	*Kings reigns.*
University.	King Alfred.	Alfred.
Baliol.	Sir John Baliol, father to the king of Scots.	Henry III.
Merton.	Walter Merton, lord chancellor and bishop of Rochester.	Edward I.
Oriel.	Edward II.	Edw. II.
Exeter.	Walter Stapleton, bishop.	Edw. II.
Queen's.	Robert Eglesfield, B. D.	Edw. III.
New College.	William of Wickham, bishop of Winchester, lord chancellor.	Edw. III.
Lincoln.	Richard Fleming, bishop of Lincoln.	Henry VI.
All-Souls.	Hugh Chicheley, archbishop of Canterbury.	Henry VI.
Magdalen.	William Wainfleet, bishop of Winchester, lord chancellor.	Henry VI.
Brazen-Nose.	William Smith, bishop of Lincoln, and Richard Sutton, Esq.	Hen. VIII.
Corpus Christi.	Richard Fox, bishop of Winchester, and lord privy seal.	Hen. VIII.
Christ-Church.	Henry VIII. and Cardinal Wolsey.	Hen. VIII.
Trinity.	Sir Thomas Pope.	Mary.
St John Baptist.	Sir Thomas White, merchant of London.	Mary.
Jesus.	Queen Elizabeth.	Elizabeth.
Wadham.	Nicolas and Dorothy Wadham.	James I.
Pembroke.	Thomas Tisdale, Esq. and Dr Richard Whitwick.	James I.

Worcester was called *Gloucester-hall* till lately, that it was endowed by Sir Thomas Coke and made collegiate.

Hartford was *Hart-hall* till 1740, that it was erected into a college by Dr Richard Newton.

All these are richly endowed, and have fine gardens, libraries, chapels, &c. The halls in which the students maintain themselves, except a few that have exhibitions, are these: St Edmund's, belonging to Queen's college; Magdalen, to Magdalen college; St Alban's, to Merton; St Mary's, to Oriel; New-Inn, to New-college. Several persons have been great benefactors to particular colleges, as Dr Ratcliffe to University college; Colonel Codrington and Dr Clarke, to All Souls; Queen Caroline, to Queen's; the beforementioned Dr Clarke and Mrs Eaton, to Worcester; Dr Wake, archbishop of Canterbury, to Christ-church. The most considerable of these colleges are Magdalen's and Christ-church, which are as noble foundations as any in the world. The church of the latter is the cathedral, and has a dean, eight canons, eight chaplains, eight singing men, eight choristers, a teacher of music, and an organist. Each of the colleges has its visitor appointed by its statutes, except Christ-church, which is subject to the visitation of the Sovereign alone. The other remarkable buildings belonging to the university are, first, the public schools; secondly, the Bodleian or public library; thirdly, Ratcliffe's library, a most elegant structure, for building and furnishing which, Dr Ratcliffe left 40,000l.; fourthly, the theatre, built by Sheldon, archbishop of Canterbury; fifthly, the museum, in which is an elaboratory and a repository for natural and artificial rarities and antiquities; sixthly, the Clarendon printing-house, so called, because it was built partly with the money arising to the university by the sale of Lord Clarendon's history. To the south of Magdalen college lies the physic garden, instituted by the earl of Danby, and much improved by Dr Sherrard. It contains five acres, in which is a complete series of such plants as grow naturally, disposed in their respective classes; together with two neat and convenient green-houses, stocked with a valuable collection of exotics, and a hot-house, where various plants brought from the warmer climates are raised. The whole body of the university, including professors, fellows, and students of all sorts, exceeds 3000. Each college has its particular statutes and rules for government. There are four terms in the year for public exercises, &c. and particular days and hours for public lectures by the several professors. The university is governed by a chancellor, high-steward, vice-chancellor, two proctors, a public orator, (see *Public* ORATOR); a keeper of the archives, a register, three esquire beadles, and three yeomen beadles. As to the city, it has had the same privileges granted to it as London, particularly an exemption from toll all over England. It was made an episcopal see in 1541, when Robert King, the last abbot of Oseney, was elected bishop. It is governed by a mayor, high-steward, recorder, four aldermen, eight assistants, two bailiffs, a town-clerk, two chamberlains, all that have borne the office of bailiff and chamberlain, and 24 common-council men; but these are subject to the chancellor or vice-chancellor of the university in all affairs of moment; and the mayor, the principal citizens, and sheriff of the county, take an oath to maintain the privileges of the university. The city, including the colleges, is a place of considerable magnitude, having 13 parish-churches, besides the cathedral, well built, clean, and regular. The number of inhabitants in 1811 was 12,931. At the entrance of the town from the Woodstock and Banbury roads, a neat hospital was erected by the trustees of Dr Ratcliffe's benefaction, out of the surplus money remaining after defraying the expence of his library. The male line of the family of Vere, to whom the city had given the title of earl for 500 years, failing in Aubrey de Vere, who was twentieth earl, Queen Anne conferred the title upon Robert Harley, a descendant of the Veres, in whose family it still continues. The chief trade of the city is in malt, conveyed in barges to London. It is impossible, in the narrow bounds necessarily prescribed to this article, to give so particular an account of this celebrated place as its importance demands: but we shall refer our readers to the article UNIVERSITY, when this seminary, amongst others, shall be more particularly described.

OXFORDSHIRE, which made part of the territory

ritory of the ancient *Dobuni*, a county of England, bounded on the west by Gloucestershire; on the south, where it is broadest, the river Isis divides it from Berkshire; on the east, it is bounded by Buckinghamshire; and on the north, where it terminates in a narrow point, it has on the one side Northamptonshire, and on the other Warwickshire. It extends 50 miles from north to south, and 35 from east to west, making about 130 in circumference: within which are contained one city, 15 market towns, 280 parishes, 14 hundreds, and 534,000 acres. The number of inhabitants in 1811 was 119,191. The air is sweet and pleasant, and the soil rich and fertile. The lower parts consist of meadows and corn-fields, and the higher were covered with woods till the civil wars; in which they were so entirely destroyed, that wood is now extremely scarce and dear, except in what is called the Chiltern, and so is coal. The county is extremely well watered; for besides the Isis, Tame, Cherwell, Evenlode, and Windrush, there is a great number of lesser rivers and brooks. One of the four great Roman ways passes quite through this county, entering at the parish of Chinner, and going out at that of Goring. There is another lesser one, that extends between Colnbrook and Wallinford, called *Gremesdike*. The county sends nine members to parliament, viz. two for the shire, two for the city, two for the university, two for New Woodstock, and one for Banbury. See OXFORDSHIRE, SUPPLEMENT.

OXGANG, or OXGATE, is generally taken, in our old law-books, for 15 acres, or as much ground as a single ox can plough in a year.

OXUS, or JIHUN, a large river of Asia, much taken notice of in ancient histories, but does not rise in the north of India, as most writers affirm; for, according to the best and latest maps made by those who have been upon the spot, it ran a course of about 260 miles from the Caspian sea to the lake Aral, whose dimensions have lately been discovered, and is but very lately known to the Europeans; but, as it passes through a desert country abounding with sands, the inhabitants so diverted its course, that the old channel can hardly be discovered.

OXYCRATE, an old term, in *Pharmacy*, denoting a mixture of vinegar and water, proper to assuage, cool, and refresh. The usual proportion is one spoonful of vinegar to five or six spoonfuls of water.

OXYDE, or OXIDE, in *Chemistry*, is the term used to denote a very numerous class of bodies formed by the union of certain bases with a smaller proportion of oxygen than what is necessary for their conversion into acids. The most remarkable of these bodies are what were formerly called metallic calces, and have for their base some metallic substance. It is in this state that metals are often contained in the ores, from which they are extracted, and converted into the metallic form, by the process called *reduction*. Metals are converted into oxides by combustion, and by solution in acids; and many of them assume this form from the action of the atmosphere alone, but more readily when this is assisted by moisture. See the history of the metals under CHEMISTRY.

OXYDATION, or OXIDATION, is a term employed to express the process by which bodies are converted into oxides. See METALS under CHEMISTRY.

OXYGEN, a term adopted in the new chemical nomenclature, to express the acidifying principle; from ὀξυς, "acid," and γινομαι, "to generate." It is not found naturally in a separate state, but always combined with some other substance. In its aeriform or elastic state, it is called *oxygenous gas*, and is the same as the *dephlogisticated air* of Priestley and Cavendish, the *empyreal air* of Scheele, the *vital* and *pure air* of other chemists. See OXYGEN, CHEMISTRY *Index*.

OXYGLYCU, a species of drink prepared of the sweetest honey-combs macerated and boiled. The combs, from which all the honey has been expressed, are put into a pot with pure water, and boiled till they seem to have deposited all their contained honey in the water. This liquor is to be kept; and, when diluted with cold water, is to be drank in the summer time, in order to remove thirst.

OXYMEL, in *Pharmacy*, a composition of vinegar and honey.

OYER, in law-books, seems to have been anciently used for what is now called *assises*. See ASSISE.

OYES, a corruption of the French OYEZ, *Hear ye*; a term or formula frequently used by the criers in our courts on making proclamations, or to enjoin silence.

OYSTER, a shell fish. See OSTREA, CONCHOLOGY *Index*.

OYSTER-Catcher. See HÆMATOPUS, ORNITHOLOGY *Index*.

OYSTERS, Fossil. The largest bed that is known of fossil oysters is that near Riding in Berkshire. Their shape is entire, and they consist of the same substance with recent oyster-shells; and yet since the oldest histories that mention the place give an account of them, we must suppose they have lain there for a long time, They extend over no less than six acres of ground; and just above them is a large stratum of a greenish loam, which some writers call a green earth, and others a green sand. It is composed of a crumbly marle, and a large portion of sand. Under them is a thick stratum of chalk. They all lie in a level bed; and the strata above the shells are natural, and appear never to have been dug through till the time of finding the shells. Phil. Trans. N° 261. p. 484.

OZÆNA, a foul and malignant ulcer of the nose, distinguished by its fœtor, and often accompanied with a caries of the bones of the nose.

OZANAM, JAMES, an eminent French mathematician, born at Bolignеux in Bresse, in 1640, of a wealthy family. His father gave him a good education, and designed him for the church; but some mathematical books falling into his hands, inspired him with a love for that science; and though he had no master to instruct him, he made such progress in it, that, at 15 years of age, he wrote a piece in mathematics, which he thought proper to insert in the works he afterwards published. He at length taught that science at Lyons; and his mathematical lessons brought him in a considerable revenue, till the year 1701: at which period, a war breaking out on the succession to the crown of Spain, he lost almost all his scholars, and was reduced to a very melancholy situation; and his wife dying the same year, he was so afflicted, that he never perfectly recovered it. In 1702 he was admitted into the Royal Academy of Sciences; and died of an apoplexy in 1717.—He was of a mild and serene

rene temper, of singular generosity, and of a cheerful disposition.—He would not allow himself to know more of religion than the common people. He used to say, that "it was the business of the doctors of the Sorbonne to dispute, of the pope to decide, and of a mathematician to go to heaven in a perpendicular line." His works are very numerous, and have met with the approbation of the learned. The principal are, 1. Practical Geometry, 12mo. 2. A mathematical dictionary, 3. A course of mathematics, 5 vols. 8vo. 4. Mathematical and philosophical recreations, the most complete edition of which is that which was improved by Montucla, and afterwards enlarged by Dr Charles Hutton, published in 1803, in four vols. 8vo. 5. An easy method of surveying. 6. New elements of algebra, a work much commended by Mons. Leibnitz. 7. Theoretical and practical perspective, &c.

OZELL, John, a well-known translator, educated in Christ's Hospital, was possessed of a competent fortune, and always enjoyed good places, being auditor-general of the city and bridge accounts, of St Paul's cathedral, and of St Thomas's hospital. Notwithstanding his attention to business, he still retained a love for polite literature: and though he did not appear as an original author, yet having made himself master of most of the living languages, he favoured the world with many translations from these, as well as from the Latin and Greek; which, if they are not the most elegant, are generally faithful and true to the originals. He died in the year 1743.

OZIAS, in sacred history, the son of Micha, of the tribe of Simeon, one of the governors of Bethulia when it was besieged by Holofernes. He vigorously supported the siege against this general, and received Achior into his house, when he had been driven from the Assyrian camp. Finding however at length that the city was reduced to great necessity for water, and that the people mutinied against him, he promised to surrender the place in five days, if in that time God did not send him relief. Judith (vi. vii. viii. ix and x.) being informed of this resolution, sent to speak with Ozias, and the other leading men of the city; made a prudent remonstrance upon their seeming to prescribe a time to the Lord, in which he must succour them; encouraged them to patience; and without discovering her design, told them that she would go out in the night. Ozias being at the gate of the city when Judith departed, opened it to her, and waited in the city for the success of her undertaking, praying with her people to God that he would be pleased to deliver them. See the article Judith.

OZOLÆ, or Ozoli, a people who inhabited the eastern parts of Ætolia which were called *Ozolea*. This tract of territory lay at the north of the bay of Corinth, and extended about 12 miles. They received their name from the bad stench (ὀζὴ) of their bodies and clothes, which were the raw hides of wild beasts. Some derive it from the stench of the stagnated water in the neighbouring lakes and marshes. According to a fabulous tradition, they received their name from a very different circumstance: During the reign of a son of Deucalion, a bitch brought into the world a stick instead of whelps. The stick was planted into the ground by the king, and it grew up to a large vine, and produced grapes, from which the inhabitants of the country were called *Ozolæ*, not from ὄζειν, "to smell bad," but from ὄζος, "a branch or sprout." The name *Ozolæ*, on account of its indelicate signification, was highly disagreeable to the inhabitants; they therefore exchanged it soon for that of Ætolians.

P.

P, THE 15th letter and 11th consonant of the alphabet; the sound of which is formed by expressing the breath somewhat more suddenly than in forming the sound of *b*; in other respects these two sounds are pretty much alike, and are often confounded one with another. When *p* stands before *t* or *s*, its sound is lost; as in the words *psalms*, *psychology*, *ptolemaic*, *ptisan*, &c. When placed before *h*, they both together have the sound *f*; as in *philosophy*, *physic*, &c.

P and *B* are so like each other, that Quintilian declares, that in the word *obtinuit*, his reason required him to put a *b*, but that his ears could hear nothing but a *p*, *optinuit*: hence in ancient inscriptions, and old glossaries, it appears that these two letters have often been confounded. Several nations still pronounce one for the other, the Welch and Germans particularly, who say, *ponum vinum*, for *bonum vinum*. Plutarch observes, it was usual for those of Delphi to say βάθειν for πάθειν, βικρὸν, for πικρὸν; and among the Latins, as often as an *s* followed, the *b* was changed into a *p*, as *scribo*, *scripsi*.

As an abbreviation, P stands for *Publius*, *Pondo*, &c. PA. DIG. for *Patricia Dignitas*; P. C. for *Patres Conscripti*; P. F. for *Publii Filius*; P. P. for *Propositum*, or *Propositum publice*; P. R. for *Populus Romanus*; P. R. S. for *Prætoris sententia*, P. R. S. P. for *Præses provinciæ*.

P. M. among *Astronomers*, is frequently used for *post meridiem*, or "afternoon;" and sometimes for *post mane*, "after the morning," i. e. after midnight. P was also used among the ancients as a numeral letter, signifying the same with the G, viz. a hundred; according to the verse of Ugutio.

P similem cum G numerum monstratur habere.

Though Baronius thinks it rather stood for seven.

When a dash was added a-top of P̄, it stood for four hundred thousand.

St Jerome observes on Daniel, that the Hebrews had no *P;* but that the *ph* served them instead thereof; adding that there is but one word in the whole Bible read with a *P*, viz. *apadno*. The Greek π signified 80. On the French coins, *P* denotes those that were struck at Dijon.

In the Italian music, P stands for *piano*, or "softly:" and P. P. P. for *pianissimo*, or "very softly."

Among physicians, P stands for *pugil*, or the eighth part of an handful; P. Æ. *partes æquales*, or equal parts of the ingredients; P. P. signifies *pulvis patrum*, or Jesuit's bark in powder; and *ppt. preparatus* or prepared.

PABULUM, among natural philosophers, the same with Fuel.

Paca, see Mus, Mammalia *Index*.

PACE, a measure taken from the space between the two feet of a man in walking; usually reckoned two feet and a half, and in some men a yard or three feet. The geometrical pace is five feet; and 60,000 such paces make one degree on the equator.

Pace, in the manege, is of three kinds, viz. walk, trot, and gallop; to which may be added an amble, because some horses have it naturally.

Horses which go shuffling, or with mixed paces between the walk and amble, are for the most part of no value; which commonly proceeds from their fiery temper, but sometimes from a weakness in their reins or legs.

PACHAMAC, a valley of Peru, in South America, ten miles south of Lima; celebrated for its pleasantness and fertility, but more on account of a magnificent temple built by the Incas of Peru, to the honour of their gods. When the Spaniards conquered Peru, they found immense riches therein.

PACHSU, a small island in the Mediterranean sea; near the coast of Epirus, and in European Turkey. It lies south of Corfu, and is subject to Venice.

PACIFIC ocean, that vast ocean which separates Asia from America. It is called *Pacific*, from the moderate weather the first mariners who sailed in it met with between the tropics; and it was called *South sea*, because the Spaniards crossed the isthmus of Darien from north to south when they first discovered it; though it is properly the Western ocean with regard to America.

Geographers call the South sea *Mare Pacificum*, "the Pacific ocean," as being less infested with storms than the Atlantic; but M. Frezier affirms it does not deserve that appellation, and that he has seen as violent storms therein as in any other sea; but Magellan happening to have a very favourable wind, and not meeting with any thing to ruffle him when he first traversed this vast ocean in 1520, gave it the name which it has retained ever since. Maty, however, adds, that the wind is so regular there, that the vessels would frequently go from Acapulco to the Philippine islands without shifting a sail.

PACK, in commerce, denotes a quantity of goods made up in loads or bales for carriage. A pack of wool is 17 stone and 2 pounds, or a horse's load.

PACKAGE, is a small duty of one penny in the pound, paid for all goods not particularly rated.

PACKET, or *Packet Boat*, a vessel appointed by the government to carry the mail of letter, packets, and expresses from one kingdom to another by sea in the most expeditious manner. Thus, the packet-boats, under the direction of the postmaster-general of Great Britain, carry the mails from Dover to Calais, from Falmouth to Lisbon, from Harwich to Helvoetsluys, and from Parkgate to Dublin. See Post.

PACOS, or Paco, in *Zoology*, a species of camel, commonly, though improperly, reckoned a species of sheep; and known among many by the name of the *Indian sheep*, or *Peruvian Sheep*. See Camelus, Mammalia *Index*.

This creature has been accounted a sheep, because its hair is so long as to resemble wool, and it is prodigiously thick, its head and neck alone having more wool on them than the whole body of our largest sheep. Its body is clothed in the same proportion with a woolly hair equally fine.

PACTOLUS, in *Ancient Geography*, a river of Lydia, called *Chrysorrhoas*, from its rolling down golden sand, according to Herodotus, Plutarch, Pliny, and Strabo; rising in Mount Tmolus (Strabo). From this river Crœsus is thought to have had all his riches. In Strabo's time it ceased to roll down any. It ran through Sardis; after which it fell into the Hermus, and both together into the Ægean sea at Phocæa in Ionia. A river celebrated by Virgil, Ovid, Lucan, Lycophron, Horace, Appollonius.

PACUVIUS, Marcus, of Brundusium in Calabria, a tragic poet in high reputation about the year of Rome 600. He was nephew of Ennius; published several theatrical pieces, though we have only some fragments of his poetry remaining; and died at Tarentum at above 90 years of age.

PADAN-ARAM (Bible), literally the *plains of Aram*, or *Syria;* translated by the Seventy simply *Mesopotamia*, or *Mesopotamia of Syria;* by the Vulgate, *Syriæ;* the Syrians on this and on the other side of the Euphrates, not differing remarkably from each other in language and manners, as Josephus allows.

PADDOC, or *Paddoc-Course*, a piece of ground encompassed with pales or a wall, and taken out of a park, for exhibiting races with greyhounds, for plates, wagers, or the like.

A paddoc is generally a mile long, and a quarter of a mile broad: at the one end is a little house where the dogs are to be entered, and whence they are slipped; near which are pens to inclose two or three deer for the sport. Along the course are several posts, viz. the low post, which is 160 yards from the dog-house and pens; the quarter of a mile post, half-mile post, and pinching post; besides the ditch, which is a place made to receive the deer, and preserve them from farther pursuit. And near this place are seats for the judges chosen to decide the wager.

The keepers, in order to slip the dogs fairly, put a falling collar upon each, slipped round a ring; and the deer being turned loose, and put forward by a teazer, as as soon as he is arrived at the low post, the dog-house door is thrown open, and the dogs slipped. If now the deer swerve so much, as that his head is judged nearer the dog-house than the ditch before he arrive at the pinching-post, it is no match, and must be run over again three days after: but if the deer runs straight beyond the pinching post, then that dog which is nearest when he swerves, or is blanched by any accident, wins the match; but if no such swerve happens, then the match is won by the dog who first leaps the ditch.

PADERBORN, a duchy of Germany in the circle of Westphalia, has the county of Lippe on the north and west; Hesse-Cassel and Waldeck, on the south; and Munster, with the duchy of Westphalia on the west. Its greatest length from east to west is about 40 miles, and its breadth where widest 30. Some parts of it yield good pasture, and breed abundance of cattle; but it is not very fruitful in corn. There is a heath called the *Senne* or *Sende*, of great extent, but very barren and desolate. There are, however, good iron mines in the country, with salt and medicinal springs, plenty of deer and other game; and it is watered with several rivers abounding with fish, as the Weser, the Dimer, the Biver, the Nette, the great Emmer, the Lippe, the Alme, and the Pader. It contains 54 parishes, in which are 25 market towns and 16 monasteries. The Roman Catholic is the predominant religion of the country, yet there are also many Protestants in it. The bishopric was erected by Charlemagne, towards the close of the eighth century, and the cathedral was consecrated by Pope Leo in person, anno 796. The bishop was sovereign of the country, a prince of the empire, and suffragan of the archbishop of Mentz. His revenue was about 30,000 pounds a-year, and he was able to raise 3000 men. In the matricula his assessment is 18 horse and 34 foot, or 352 florins monthly in lieu of them. Towards the charges of the sovereign courts of the empire, he paid for each term 162 rix-dollars and 29 kruitzers. The chapter consisted of 24 capitular canons, who must prove their noble extraction by four descents. At the settling of the indemnities in 1802 this bishopric was secularised and given to Prussia. It was afterwards annexed to the kingdom of Westphalia, but was restored to Prussia in 1814. It is reckoned to contain 76,000 inhabitants. It was in this bishopric that Quintilius Varus, with the Roman army under his command, was routed by the Germans under Arminius.

PADERBORN, the capital of the above bishopric. It stands 40 miles north-west of Cassel, 50 south-east of Munster, and 60 south-west of Hanover; being a large, populous, well built, and well fortified city. Its name is compounded of *pader*, a rivulet, which rises just under the high altar of the cathedral, and *born*, i. e. a spring. It was one of the Hanse-towns; and, till 1604, an imperial city. The cathedral is a grand fabric, inferior to few in the empire. There is a gold crucifix in it of 60 pounds weight, presented by Otho II. The university, of which the Jesuits have the direction, was founded in 1592, and the walls were built in the beginning of the 11th century. In 1530 an attempt was made to introduce Lutheranism; but 16 of the principal citizens who had embraced it were executed, and the rest obliged to abjure it. Duke Christian of Brunswick carried off from hence, in 1692, the silver images of the twelve apostles, and the silver coffin of St Lotharius; and had them coined into money, with this inscription, *God's Friend, the Priest's Enemy*. The trade of this town, though formerly great, is now inconsiderable; and the inhabitants subsist mostly by agriculture and breeding of cattle. Though the bishop had a palace in the city, he resided at Neuhaus, seven miles off, where he had a magnificent castle. Charlemagne and other emperors sometimes resided here, and held diets of the empire. Paderborn contains about 12,000 inhabitants.

PADOGI, a punishment used in Russia. The body of the criminal is stripped to the waist, and then laid upon the ground; one slave holds the head of the person to be punished between his knees, and another the lower part of the body; then rods are applied to the back till some person gives notice to desist, by crying out, enough. This punishment is considered in Russia merely as a correction of the police, exercised on the soldier by military discipline, by the nobility on their servants, and by persons in authority over all such as are under their command. After the accession of Elizabeth to the throne of Russia, the punishments were reduced to two kinds, viz. the padogi and KNOUT.

PADUA, an ancient, large, and celebrated city of Italy, with a university and a bishop's see. It is also capital of the Paduano; but is much less considerable than it was formerly: for it now contains no more than 30,000 inhabitants, whereas it formerly had 100,000, and many of the houses are gone to ruin. The cathedral church, and the college of the university, are in that part called the *Old Town;* and there are piazzas under all the houses, where persons may walk without being exposed to the weather. The garden of the university is curious, on account of the number of plants. Here a student may take his degrees, let him be of what sect of Christianity he will; nay, though he should be a Jew or a Turk. The patron of this city is St Anthony, who lies in the cathedral; they have such a veneration for him, that the beggars do not ask charity in the name of God, but for the love of St Anthony. The Jews live in a distinct part of the city; and the neighbouring mountains produce excellent wine and oil, with delicious fruit. It was taken by the Venetians in 1706, and now belongs to Austria. It is seated on the rivers Brentac and Bachiglione, in a fine plain, and is about seven miles in circumference. E. Long. 11. 55. N. Lat. 45. 24.

PADUAN, among medalists, a modern medal struck in imitation of the antique, or a new medal struck with all the marks and characters of antiquity. This name is properly applicable to those medals only that were struck in the seventh century by an Italian painter born at Padua; who succeeded so well in the imposture, that the best judges are at a loss to distinguish his medals from the genuine ones. Though it is frequently used in general for all medals of this kind.

PADUANO, a small province of Italy, in the Austro-Venetian territories, bounded on the east by the Dogado, on the south by the Polesino di Rovigo, on the west by the Veronese, and on the north by the Vicentino. Its soil is well watered, and is one of the most fertile in Italy. The province is about 40 miles in length, and 35 in breadth. Padua is the capital town.

PADUS, now the Po, anciently called *Eridanus*, especially by the Greeks; a river famous for the fable of Phaeton (Ovid). It rises in Mount Vesulus, in the Alpes Cothiæ, from three springs, dividing the Cisalpine Gaul into the Transpadana and Cispadana, (Strabo); and swelled by other rivers falling into it on each side from the Alps and Apennines, it discharges itself with a course from west to east, at seven months, into the Adriatic (Mela). The lake through which it discharges itself into the sea, is called by the natives the *Seven Seas*.

PADUS, a species of cherry. See PRUNUS, BOTANY *Index*.

PÆAN, among the ancient pagans, was a song of rejoicing sung in honour of Apollo, chiefly used on occasions of victory and triumph. See APOLLO.

PÆAN, in the ancient poetry, a foot consisting of four syllables; of which there are four kinds, the pæan primus, secundus, &c.

The pæan primus consists of one long syllable and three short ones, or a trochæus and pyrrhichius, as *temporibus;* the pæan secundus consists of a short syllable, a long, and two short, or an iambus and a pyrrhichius, as *potentia;* the pæan tertius consists of two short syllables, a long and a short one, or a pyrrhichius and a trochæus, as *animatus;* the pæan quartus consists of three short syllables and a long one, or a pyrrhichius and iambus, as *celeritas*.

PÆDEROTA, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 30th order, *Contortæ*. See BOTANY *Index*.

PÆDO BAPTISM; infant baptism, or that conferred on children: from παις, *infant*, and βαπτισμος, *baptism*. This has been the subject of great controversy in the church. See ANABAPTISTS, BAPTISTS, &c.

PÆONIA, PIONY, a genus of plants belonging to the polyandria class, and in the natural method ranking under the 26th order, *Multisiliquæ*. See BOTANY *Index*.

PÆSTUM, called *Posidonia* by the Greeks, a town of Lucania, on the Sinus Pæstinus; an ancient colony prior to the first Punic war, according to Livy; but later, according to Velleius. *Pæstanæ rosæ* were in great esteem, and produced twice a-year (Virgil, Ovid.)

PAGAN, BLAISE FRANCOIS COMTE DE, an eminent French mathematician, was born at Avignon in Provence, March 3. 1604; and took to the profession of a soldier at fourteen, having been bred to it with the greatest care. In 1620 he was engaged at the siege of Caen, in the battle of Pont de Ce, and the reduction of the Navareins, and the rest of Bearn; where he signalized himself, and acquired a reputation far surpassing his years. He was present, in 1621, at the siege of St John d'Angeli, as also that of Clarac and Montauban, where he lost his left eye by a musket-shot. At this siege he had another loss, which equally afflicted him, viz. that of the constable of Luynes, who died there of a scarlet fever. The constable was a near relation, and had been his patron at court. He did not, however, sink under the misfortune, but on the contrary took fresh spirits from the necessity he was now in of trusting solely to himself. Accordingly there happened after this time neither siege, battle, nor any other occasion, in which he did not signalize himself by some effort of courage and conduct. At the passage of the Alps, and the barricade of Suza, he put himself at the head of the forlorn hope, consisting of the bravest youths among the guards; and undertook to arrive the first at the attack, by a private way which was extremely dangerous; when, having gained the top of a very steep mountain, he cried out to his followers, "See the way to glory!" He slipt along this mountain; and, his companions following him, they came first to the attack, as they wished to do. They immediately began a furious assault; and, the army coming to assist, they forced the barricades. He had afterwards the pleasure of standing on the left hand of the king, when his majesty related this heroic action to the duke of Savoy with the deserved commendations, in the presence of a very full court. When the king laid siege to Nancy in 1633, our hero had the honour to attend his sovereign, in drawing the lines and forts of circumvallation. In 1642 his majesty sent him to the service in Portugal, in the post of field marshal. In this same year he unfortunately lost his eye sight by a distemper. But though he was thus disabled from serving his country with his conduct and courage, he reassumed, with greater vigour than ever, the study of the mathematics and fortification; and in 1645, gave the public a treatise on this latter subject. It was allowed by all who understood the science, that nothing had then appeared that was preferable to it; and, indeed, whatever improvements have been made since, they have perhaps been derived chiefly from this treatise, as conclusions from their principles. In 1651 he published his Geometrical Theorems, which show a perfect knowledge of all the parts of the mathematics. In 1655 he printed A Paraphrase, in French, of the Account, in Spanish, of the River of the Amazons, by Father de Rennes, a Jesuit; and we are assured, that though blind, he drew the chart of that river and the parts adjacent which is seen in this work. In 1657 he published The Theory of the Planets, cleared from that multiplicity of eccentric circles and epicycles, which the astronomers had invented to explain their motions. This work distinguished him among astronomers as much as that of fortifications did among engineers; and he printed, in 1658, his Astronomical Tables, which are very succinct and plain. Few great men are without some foible: Pagan's was that of a prejudice in favour of judicial astrology; and though he is more reserved than most others, yet we cannot put what he did on that subject among those productions which do honour to his understanding. He was beloved and respected by all persons illustrious for rank as well as science: and his house was the rendezvous of all the polite and worthy both in city and court. He died at Paris, Nov. 18. 1665; and was never married. The king ordered his first physician to attend him in his illness, and gave several marks of the extraordinary esteem which he had for his merit.

He had an universal genius; and, having turned himself entirely to the art of war, and particularly to the branch of fortification, he made extraordinary progress in it. He understood mathematics not only better than is usual for a gentleman whose view is to push his fortune in the army, but even to a degree of perfection superior to that of the ordinary masters who teach that science. He had so particular a genius for this kind of learning, that he obtained it more readily by meditation than

than by reading authors upon it; and accordingly spent less time in such books than he did in those of history and geography. He had also made morality and politics his particular study; so that he may be said to have drawn his own character in his *Homme Heroique*, and to have been one of the completest gentlemen of his time. Louis XIII. was heard to say several times, that the count de Pagan was one of the most worthy, best turned, most adroit, and most valiant men, in his kingdom.—That branch of his family, which removed from Naples to France in 1552, became extinct in his person.

PAGAN, a heathen, gentile, or idolater; one who adores false gods. See MYTHOLOGY.

PAGANALIA, certain festivals observed by the ancient Romans in the month of January. They were instituted by Servius Tullius, who appointed a certain number of villages (*pagi*), in each of which an altar was to be raised for annual sacrifices to their tutelar gods; at which all the inhabitants were to assist, and give presents in money, according to their sex and age, by which means the number of country-people was known. The servants upon this occasion offered cakes to Ceres and Tellus, to obtain plentiful harvests.

PAGANELLUS, a species of fish. See GOBIUS, ICHTHYOLOGY *Index*.

PAGANISM, the religious worship and discipline of pagans: or, the adoration of idols and false gods. See IDOLATRY, MYTHOLOGY, and POLYTHEISM.

PAGEANT, a triumphal car, chariot, arch, or other like pompous decoration, variously adorned with colours, flags, &c. carried about in public shows, processions, &c.

PAGI, ANTONY, a very famous Cordelier, and one of the ablest critics of his time, was born at Rogne in Provence in 1624. He took the habit in the convent at Arles in 1641, and was at length four times provincial of his order; but his religious duties did not prevent his vigorous application to the study of chronology and ecclesiastical history, in which he excelled. His most considerable work is, A Critique upon the Annals of Baronius; where, following the learned cardinal year by year, he has rectified an infinite number of mistakes both in chronology and in the representation of facts. He published the first volume in 1689, dedicated to the clergy of France, who allowed him a pension: the whole was printed after his death, in 4 vols folio, at Geneva, in 1705, by the care of his nephew Francis Pagi, of the same order. He wrote some other things before his death, which happened in 1699; and had the character of an able historian as well as of a learned and candid critic. His nephew Francis, above mentioned, wrote a Chronological Abridgement of the History of the Popes, in Latin, 3 vols 4to. Francis had also a nephew, Anthony Pagi, who added three more volumes to the History of the Popes; of which two more were intended, if not executed.

PAGNINUS, SANCTES, an Italian dominican, eminent for his skill in oriental languages and biblical learning, was born at Lucca in 1466, and became afterwards an ecclesiastic of the order of St Dominic. He was deeply and accurately skilled in Latin, Greek, Hebrew, Chaldee, and Arabic; but he was particularly excellent in the Hebrew. He applied himself to examine the vulgar translation of the Scriptures; and believing it to be either not of Jerome, or greatly corrupted, he undertook to make a new one from the present Hebrew text; in which he meant to imitate St Jerome, who set about making a new translation at a time when the church would admit no other but the Septuagint. This design of Pagninus, so early after the restoration of letters, seemed a bold one; yet such was the reputation of the man, that it was approved by Pope Leo X. who promised to furnish him with all necessary expences for carrying on the work: and, besides, we find at the beginning of his translation, which was printed at Lyons in 1527, two letters of the succeeding popes, Hadrian VI. and Clement VII. which licensed the printing of it. Pagninus, in his Letters to Pope Clement, for the printing of this translation, openly declares, that the Vulgar edition, as it is at present, is not St Jerome's; yet adds, that he has retained in his translation as much of it as he could. It appears by a letter of Picus Mirandula to Pagninus, that he had spent 25 years upon this translation. It is the first modern translation of the Bible from the Hebrew text; and the Jews who read it affirmed, that it agreed exactly with the Hebrew, and was in some respects superior to the ancient translations. The great fault of Pagninus was, that he adhered with too great servility to the original text; and this scrupulous attachment made his translation, says Father Simon, "obscure, barbarous, and full of solecisms. He imagined, that to make a faithful translation of the Scriptures, it was necessary to follow exactly the letter according to the strictness of grammar. This, however, is quite contrary to his pretended exactness, because two languages seldom agree in their ways of speaking; and therefore, instead of expressing the original in its proper purity, he defaces and robs it of all its ornaments." Father Simon nevertheless allows the great abilities and learning of Pagninus; and all the later commentators and translators of the Scriptures have agreed in giving him his just praise. Huetius, though he thinks Father Simon's criticism of him just and well grounded, yet proposes his manner as a model for all translators of the sacred books: *Scripturæ interpretandæ rationis utile nobis exemplar proposuit Sanctus Pagninus.* He alsotranslated the New Testament from the Greek, as he had done the Old from the Hebrew, laying the Vulgar all the while before him; and dedicated it to Pope Clement VII. He was author of a Hebrew Lexicon, and a Hebrew Grammar: which Buxtorf, who calls him *vir linguarum Orientalium peritissimus*, made great use of in compiling his. He died in 1536, aged 70. Luther spoke of him and his translations in terms of the highest applause.

PAGO, an island in the gulf of Venice, separated from the continent of Morlachia by a narrow channel. The ancient geographers have left us no description of it: though (as Fortis observes) its form (A), extent, and rich produce, unquestionably deserved it." And this

(A) Its figure is indeed remarkably irregular, its breadth being in no proportion to its length; for one of the extremities, called *Punta di Loni*, is above ten miles long, and less than one broad. Almost all the circumference is

Pago.

this is the more unaccountable, as we know the Romans were well acquainted with it; and on the other islands adjoining to it are many vestiges of buildings, inscriptions, tiles, and hewn stones, all sure signs of Roman habitations. Its ancient name was in all probability *Portunata*. "This island (says Mr Fortis*) is extended from north to south over against maritime Croatia, or the mountain Morlacca. It is about 50 miles long; its breadth is unequal. One particular circumstance distinguishes it from all the other islands of the Adriatic, and is a large internal salt-water lake 15 miles long from south to north, into which the sea enters by a canal not above a quarter of a mile broad in some places. This lake is frequented by the tunny fish, which, when once in, cannot return again to the sea. There are also two smaller lakes on the island; one near Vlassich, abounding in fish, particularly eels; and one near the hamlet of Slabine.

* *Travels into Dalmatia.*

"In this island the winter is dreadfully cold, and the summer scorchingly hot. Those who have been there in the winter time speak of it as a Siberia quite covered with snow and ice, and always exposed to the cold north wind; I, who was there in the hot season, thought it equal to the most scorching parts of the world. The naked rocks, which not only form the organization, but also the superficies of almost all the island; the narrowness of the valleys; the reverberation of the water of the lake, generally quite calm in summer; multiply the heat so prodigiously among those stones, that the vines, which are planted all round the lake, ripen their grapes by the beginning of August; and the other products that grow there anticipate the usual time of maturity in the same manner. The meteors are exceedingly irregular in the summer time; sudden whirlwinds are frequent, and heavy showers of rain: the last are hurtful to the inhabitants of one part of the island, and are favourable to the cultivation of the opposite end.

"They cultivate neither corn nor oil on this island; but it produces plenty of wine, and an immense quantity of salt. The other products are wool, honey, and a little salt fish. The quantity of wine amounts annually, on a medium, to 40,000 Venetian barrels; and from the husks, they distil 2000 barrels of *rakia* or brandy. The salt, in 1663, amounted to 800,000 Venetian *stare*. The salt-works are well contrived and well kept: they extend along a shallow pool, which forms the eastern extremity of the lake within for four miles in length and about half a mile in breadth. On the sides of this fen the best part of the vines lie; but the upper part of the hills on each side is altogether naked and barren; there is not even a sufficiency of fire-wood, and the inhabitants are obliged to provide themselves elsewhere. The soil at the foot of the hills, where the vines are planted, is full of gravel and small stones: and hence the wine is of good quality. The air is not unhealthful, notwithstanding the vicinity of the salt pits; but the frequent high winds carry off the noxious exhalations. The most considerable product of the island is the salt. The greatest part of the people of Pago live by working in the salt pits, and have a comfortable subsistence regularly paid by the government: it is therefore a very important circumstance for the inhabitants of the city to have a dry summer; and hence the ignorant vulgar look upon rain as a mischief brought upon the country by the force of witchcraft. In consequence of this idea, they elect a friar to exercise the meteors, and keep the rain off the island. If, notwithstanding the poor friar's endeavours, the summer happens to be rainy, he loses his reputation and his bread; but if two or three dry seasons follow successively, he meets with great reverence and advantage. Part of the salt works belongs to the government, and the rest to private proprietors; they are meliorated every year; and for that end the public lends money to those proprietors who want it, and who without that assistance could not make the requisite improvements.

"Many vestiges of ancient habitations still remain on the island of Pago, as well as of walled places, which either have been destroyed by the incursions of enemies or by time. Historians say that the island was often abandoned by its inhabitants; and indeed it is rather to be wondered at how men ever could resolve to settle in so wretched a country. The small number of inhabitants, after so many years of peace and tranquillity under the Venetian government, evidently proves how little the island is really habitable. The town of Pago was built by the Venetians about 300 years ago; and contains upwards of 2000 inhabitants, and all the rest of the island scarcely 900. The difficulty of access to the city of Pago, and the ill accommodation that strangers meet with, make it very little frequented. Hence the inhabitants are as wild and unpolished as if they lay at the greatest distance from the sea and the commerce of polite people. The gentry, who pretend to show their manners different from those of the vulgar, are truly grotesque figures, both in their dress, behaviour, and insolent pretensions. The ignorance of their clergy is incredible; a priest of the greatest consequence there, and who was thought a man of learning, did not know how Pago was called in Latin. There are two convents of friars in Pago and one of nuns; and several churches, all in very bad order, and ill served. At Terra Vecchia also there is a convent of Franciscan monks; a race of men who, under various names and disguises, infest every place where credulous ignorance can be persuaded to maintain the idle and superstitious. One superstitious custom,

is dismal, without trees or any kind of visible plants or grass, steep, craggy, and uninhabited. On entering the lake through the channel that communicates with the sea, nothing is to be seen either on the right or left but bare hanging rocks, so disfigured on the outside by the violent percussion of the waves, that the stratification is hardly distinguishable. In general, the stone of the island is of the same kind as the Istrian, or *breccia*; and, besides, there are large strata of blue and yellowish sandstone. The channel, or inward bay of Pago, is not a harbour; on the contrary, it is a very dangerous station, and even inaccessible in winter, when the north wind blows with such fury, that the inhabitants of the town dare not stir out of their houses, and much less the few that are scattered over the country. The sky appears always cloudy in that season, by the thick mist that arises from the repercussion of the waves on that long chain of rough and hollow rocks.

custom, amongst a variety of others, exists among their women, and particularly among those who have been married but a short time: if their husband happens to die, they tear their hair out in good earnest, and scatter it on the coffin; and this ceremony is so much consecrated by custom, that no woman, even though she had notoriously hated her husband, would fail in performing it."

PAGOD, or PAGODA, a name given by the East Indians to the temples where they worship their gods. We shall not in this place enter into a full detail of the several pagodas of different nations, and their peculiar circumstances. These matters seem to come in more properly under the *religion*, or, as others will call it, the *superstition*, of the people to whom they belong. We shall therefore content ourselves in the present article with an account of a paper in the *Asiatic Researches*, concerning the sculptures, &c. at Mavalipuram, a few miles north of Sadras, and known to seamen by the name of the *seven pagodas*.

The monuments which Mr Chambers (who communicated the paper) describes, appear, he says, to be the ruins of some great city decayed many centuries ago. "They are situated close to the sea, between Covelong and Sadras, somewhat remote from the high road that leads to the different European settlements. And when visited in 1776, there was still a native village adjoining to them which retained the ancient name, and in which a number of *bramins* resided that seemed perfectly well acquainted with the subjects of most of the sculptures to be seen there.—The rock, or rather hill of stone, on which great part of these works are executed, is one of the principal marks for mariners as they approach the coast, and to them the place is known by the name of the *Seven Pagodas*, possibly because the summits of the rock have presented them with that idea as they passed: but it must be confessed that no aspect which the hill assumes as viewed on the shore, seems at all to authorize this notion; and there are circumstances, which will be mentioned in the sequel, that would lead one to suspect that this name has arisen from some such number of pagodas that formerly stood here, and in time have been buried in the waves." The rock here mentioned, as it rises abruptly out of a level plain of great extent, naturally engrosses the attention of the eye. It consists chiefly of a single stone; and in its shape (which is singular and romantic), in a distant view, it has the appearance of an antique and lofty edifice. Works of imagery and sculpture crowd thicker upon the eye on a nearer approach, and at first sight at least favours the idea of a petrified town, which, through the credulity of travellers *, has been supposed to exist in various parts of the world. "Proceeding on by the foot of the hill on the side facing the sea, there is a pagoda rising out of the ground, of one solid stone, about 16 or 18 feet high, which seems to have been cut upon the spot out of a detached rock that has been found of a proper size for that purpose. The top is arched, and the style of architecture according to which it is formed, different from any now used in these parts." Beyond this a numerous group of human figures in bass relief, considerably larger than life, attract attention. They represent considerable persons, and their exploits, many of which are now very indistinct through the injuries of time, assisted by the corroding nature of the sea air; others, while protected from that element, are as fresh as when recently finished.

* See Shaw's Travels, p. 155, &c.

The hill, which is at first of easy ascent, "is in other parts rendered more so, by very excellent steps cut out in several places, where the communication would be difficult or impracticable without them. A winding stair of this sort leads to a kind of temple cut out of the solid rock, with some figures of idols in high relief upon its walls, very well finished and perfectly fresh, as it faces the west, and is therefore sheltered from the sea air." This temple our author conjectures to have been a place of worship appertaining to a palace; some remains of which still exist, and to which there is a passage from the temple by another flight of steps. This conjecture (for it is brought forward as merely such) is in some measure favoured by several ruins still remaining, and by the tradition of the bramins who inhabit the place. This finishes the objects "on that part of the upper surface of the hill, the ascent to which is on the north; but on descending from thence, you are led round the hill to the opposite side, in which there are steps cut from the bottom to a place near the summit, where is an excavation that seems to have been intended for a place of worship, and contains various sculptures of Hindoo deities. The most remarkable of these is a gigantic figure of *Vishnou* (A), asleep on a kind of bed, with a huge snake wound about in many coils by way of pillow for his head; and these figures, according to the manner of this place, are all of one piece hewn from the body of the rock." These works, however, although they are unquestionably stupendous, are, in our author's opinion, surpassed by others about a mile and a half to the southward of the hill. "They consist of two pagodas of about 30 feet long by 20 feet wide, and about as many in height, cut out of the solid rock, and each consisting originally of one single stone. Near these also stand an elephant full as big as life, and a lion much larger than the natural size, but very well executed, each hewn also out of one stone. None of the pieces that have fallen off in cutting these extraordinary sculptures are now to be found near or any where in the neighbourhood of them, so that there is no means of ascertaining the degree of labour and time that has been spent upon them, nor the size of the rock or rocks from which they have been hewn; a circumstance which renders their appearance the more striking and singular. And though their situation is very near the sea beach, they have not suffered at all by the corrosive air of that element, which has provided them with a defence against itself, by throwing up before them a high bank that completely shelters them. There is also a great symmetry in their form, though that of the pagodas is different from the style of architecture according to which idol temples are now built in that country. The latter resembles the Egyptian; for the towers are always pyramidical, and the gates and roofs flat and without arches; but these sculptures approach nearer to the Gothic.

(A) See a figure of *Vishnou* in the plate of Indian gods, with its description, under the article POLYTHEISM.

Pagod. thic taste, being surmounted by arched roofs or domes that are not semicircular, but composed of two segments of circles meeting in a point at top." Our author observes, that the lion in this group, as well as one on a stone couch in what he took to be a royal palace, are perfectly just representations of the true lion, and the natives there give them the name which is always understood to mean a lion in the Hindoo language, to wit, *sing*; but the figure which they have made to represent that animal in their idol temples for centuries past, though it bears the same appellation, is a distorted monster, totally unlike the original; insomuch that it has from hence been supposed, that the lion was not anciently known in this country, and that *sing* was a name given to a monster that existed only in Hindoo romance. But it is plain that that animal was well known to the authors of these works, who, in manners as well as arts, seem to have differed much from the modern Hindoos.

"There are two circumstances attending these monuments which cannot but excite great curiosity, and on which future inquiries may possibly throw some light. One is, that on one of the pagodas last mentioned, there is an inscription of a single line, in a character at present unknown to the Hindoos. It resembles neither the Deyva-nâgre, nor any of the various characters connected with or derived from it, which have come to the writer's knowledge from any part of Hindostan. Nor did it, at the time he viewed it, appear to correspond with any character, Asiatic or European, that is commonly known. He had not then, however, seen the alphabet of the Balic, the learned language of the Siamese, a sight of which has since raised in his mind a suspicion that there is a near affinity between them, if the character be not identically the same. But as these conjectures, after such a lapse of time, are somewhat vague, and the subject of them is perhaps yet within the reach of our researches, it is to be hoped that some method may be fallen upon of procuring an exact copy of this inscription.

"The other circumstance is, that though the outward form of the pagodas is complete, the ultimate design of them has manifestly not been accomplished, but seems to have been defeated by some extraordinary convulsion of nature. For the western side of the most northerly one is excavated to the depth of four or five feet, and a row of pillars left on the outside to support the roof; but here the work has been stopped, and an uniform rent of about four inches breadth has been made throughout the solid rock, and appears to extend to its foundations, which are probably at a prodigious depth below the surface of the ground. That this rent has happened since the work began, or while it was carrying on, cannot be doubted; for the marks of the masons tools are perfectly visible on the excavated part on both sides of the rent, in such a manner as to show plainly that they have been divided by it. Nor is it reasonable to suppose, that such a work would ever have been designed or begun upon a rock that had previously been rent in two. Nothing less than an earthquake, and that a violent one, could apparently have produced such a fissure in the solid rock: and that this has been the case in point of fact, may be gathered from other circumstances, which it is necessary to mention in an account of this curious place. The great rock above described is at some small distance from the sea, perhaps 50 or 100 yards, and in that space the Hindoo village before mentioned stood in 1776. But close to the sea are the remains of a pagoda built of brick, and dedicated to Sib, the greatest part of which has evidently been swallowed up by that element; for the door of the innermost apartment, in which the idol is placed, and before which there are always two or three spacious courts surrounded with walls, is now washed by the waves, and the pillar used to discover the meridian at the time of founding the pagoda is seen standing at some distance in the sea. In the neighbourhood of this building there are some detached rocks, washed also by the waves, on which there appear sculptures, though now much worn and defaced. And the natives of the place declared to the writer of this account, that the more aged people among them remembered to have seen the tops of several pagodas far out in the sea, which being covered with copper, (probably gilt) were particularly visible at sunrise, as their shining surface used then to reflect the sun's rays, but that now that effect was no longer produced, as the copper had since become incrusted with the mould and verdegrise."

From these circumstances our author conjectures, and we think reasonably, that the magnificent city of which these appear to be part of the ruins, has been destroyed partly by an earthquake, by which the rock was rent, and partly by a sudden inundation of the sea, occasioned by this commotion of the earth. The bramins give an account of this matter peculiar to themselves, filled with extravagance, fable, and folly; from which, however, with the assistance of ancient monuments, coins, and inscriptions, some probable conjectures at least, if not important discoveries, may, it is hoped, be made on these subjects, which are far from being uninteresting to us either as men, philosophers, or Christians. Our author thinks, therefore, that the inscription on the pagoda mentioned above is an object which merits considerable attention; and he defends, by very reputable authorities, the conjecture which places it among the languages of *Siam*; but which it is unnecessary for us either to abridge or to transcribe. In the course of this inquiry, our author remarks a very near resemblance between *Sommonacodom*, the idol of the *Siamese*, and the great idol Buddou, held sacred by the *Chingelays*; and this resemblance extends also to their priests. But from the detail of circumstances which our author brings forward, and to which we refer, he thinks this a system of religion different from that of the *Veds*, and some of them totally inconsistent with the principles and practice of the *bramins*; none of whom, as far as we can collect from Mr Knox †, exist among the Chingelays, whose religion is totally different from that of the present Hindoos. The only part in which there seems to be any agreement is in the worship of the Debtahs, which has probably crept in among them from their Tamulian neighbours, but that is carried on in a manner very different from the braminical system, and appears to be held by the nation at large in very great contempt, if not abhorrence. Knox's account of it is this: "Their temples (i. e. those of the Debtahs) are called *covels*," which is the Tamulic word for pagoda. He then goes on to say, "a man piously disposed builds a small house at his own charge,

† *Hist. of Ceylon.*

Pagod.

charge, which is the temple, and himself becomes priest thereof. This house is seldom called *God's house*, but most usually *Jaco the devil's*." But of the prevailing religion he speaks in very different terms, and describes it as carried on with much parade and splendour, and attended with marks of great antiquity, "The pagodas or temples of their gods (says he) are so many, that I cannot number them. Many of them are of rare and exquisite work, built of hewn stone, engraven with images and figures, but by whom and when I could not attain to know, the inhabitants themselves being ignorant therein. But sure I am they were built by far more ingenious artificers than the Chingelays that now are on the land. For the Portuguese in their invasions have defaced some of them, which there is none found that hath skill enough to repair to this day." In another place, he says, "here are some ancient writings engraven upon rocks, which puzzle all that see them. There are divers great rocks in divers parts in Cande Uda, and in the northern parts. These rocks are cut deep with great letters for the space of some yards, so deep that they may last to the world's end. No body can read them or make any thing of them. I have asked Malabars and Gentoos, as well as Chingelays and Moors, but none of them understood them. There is an ancient temple, Goddiladenni in Yattanour, stands by a place where there are of these letters." From all which the antiquity of the nation and their religion is sufficiently evident, and from other passages it is plain, that the worship of Buddou, in particular, has been from remote times a very eminent part of their religion; for the same author, speaking of the tree at Anurodgburro, in the northern part of the island, which is sacred to Buddou, says, "the due performance of this worship they reckon not a little meritorious: insomuch that, as they report, 90 kings have reigned there successively, where, by the ruins that still remain, it appears they spared not for pains and labour, to build temples and high monuments to the honour of this god, as if they had been born to hew rocks and great stones, and lay them up in heaps. These kings are now happy spirits, having merited it by these labours." And again he says, "For this god, above all others, they seem to have a high respect and devotion," &c.

Such is the nature of Mr Chambers's communication, as far as it respects pagodas; a subject to which the *Asiatic Society* will doubtless again direct their attention; and from the penetration and assiduity of its members we have much to expect. Other parts of this paper shall be brought forwards under other articles, to which we refer. Few researches are of more service to true religion, than those which give us a correct view of the false and superstitious modes of worship practised by men who have had no light but reason, or weak and corrupted traditions. They are useful likewise to the philosopher, as they always tend to give us a minuter view of the real nature of man as he is in himself, and show with sufficient strength the imbecility of the human intellect without some supernatural aid. The external pomp of all pagan religions seems to have been their essence; a circumstance which alone shows the necessity of that, the intention of which is to reform the heart. See Siam, Sommonacodon, Temple, &c.

Pagod. Pain.

Pagod, or Pagoda, is also the name of a gold and silver coin, current in several parts of the East Indies.

PAIN, an uneasy sensation, arising from a sudden and violent solution of continuity, or other accident in the nerves, membranes, vessels, muscles, &c. of the body. Pain, according to some, consists in a motion of the organs of sense; and, according to others, it is an emotion of the soul occasioned by those organs.

As the brain is the seat of sensation, so it is of pain. Boerhaave, and most other authors on this subject, assign a stretching of the nerves as the only immediate cause of pain: but as the nerves do not appear to consist of fibres, this cause of pain does not seem to be well-founded; nor indeed will it be easy to treat this subject clearly, but in proportion as the means of sensation are understood.

Many kinds of pain are met with in authors: such as, A gravitative pain; in which there is a sense of weight on the part affected, which is always some fleshy part, as the liver, &c. A pulsative pain; which, Galen says, always succeeds some remarkable inflammation in the containing parts, and is observed in abscesses while suppurating. A tensive pain, which is also called a *distending* pain; it is excited by the distension of some nervous, muscular, or membranous part, either from some humour, or from flatulence. An acute pain is, when great pain is attended with quick and lively sensations: A dull pain is, when a kind of numbness is as much complained of as the pain is.

The mediate and more remote causes of pain are generally obvious; and when this is the case, the cure will consist for the most part in removing them: for though in many instances the chief complaint is very distant from the seat of those causes, yet their removal is the proper method of relief. See Medicine, *passim*.

Perhaps all pains may be included, with irritation, in those that have spasm or inflammation for their source. When pain is owing to inflammation, the pulse is quicker than in a natural state; it is also generally full, hard, and tense; the pain is equal, throbbing, and unremitting. If a spasm be the cause, the pulse is rarely affected; at intervals the pain abates, and then returns with some degree of aggravation; gentle motion sometimes abates, or even cures, in some instances; but in inflammatory cases no such effects are ever experienced. See Dr Lobb's *Treatise on Painful Distempers*.

The pain so frequently attendant on women in childbed, called *after-pains* (from their happening only after being delivered of a child), are often occasioned by attempts to bring away coagulated blood, which is a needless endeavour. When no improper treatment in delivering the secundines can be suspected, the irritability of the uterus alone is to be considered as the cause. Care should be taken not to confound these after-pains with, or mistake the pains attending puerperal fevers for the colic. After-pains come by fits, and soon go off; but return at different intervals, which are longer each day, and after two or three days are usually at an end, though sometimes they continue seven or eight: notwithstanding these pains, the lochia flow properly, and generally more abundantly after the cessation of each fit; this does not happen in colicky complaints, nor is the belly so free from tumefaction when the puerperal fever is attendant.

As these pains are of the spasmodic kind, anodynes and

Pain. and gentle opiates, with frequent draughts of warm caudle, chamomile tea, &c. with external fomentation, are all that are required in order to their relief.

Among the various causes of pain, a singular one is related in the third vol. of the *Lond. Med. Obs. and Inq.* p. 241, &c. Some persons who had taken cold during their being salivated, were afflicted with pains which resisted all the usual methods of relief. At length the author of the narrative referred to suggested the cause; and by exciting a fresh salivation the pains abated; the spitting was kept up a little while, and permitted to abate with some caution; and thus the cures were completed.

PAINTING.

PAINTING is the art of representing to the eye, by means of figures and colours, every object in nature that is discernible by the sight: and of sometimes expressing, according to the principles of physiognomy, and by the attitudes of the body, the various emotions of the mind. A smooth surface, by means of lines and colours, represents objects in a state of projection; and may represent them in the most pleasant dress, and in a manner most capable of enchanting the senses. Still farther, the objects which delight us by their animation and lively colours, speak to the soul, by giving us the image of what we hold most dear, or by indicating an action which inspires us with a taste for innocent pleasures, with courage, and with elevated sentiments. Such is the definition, and such are the effects of painting.

By an admirable effort of human genius, painting offers to the eye every thing which is most valuable in the universe. Its empire extends over every age and country. It presents to us the heroic deeds of ancient times as well as the facts in which we are more conversant, and distant objects as well as those which we daily see. In this respect it may be considered as a supplement to nature, which gives us only a view of present objects.

The art of painting is extremely difficult in the execution; and its merit can only be appreciated by those who profess the art.

The painter who invents, composes, and colours conceptions which are only agreeable, and which speak merely to the eye of the spectator, may be reckoned to possess the first merit in the style of embellishment and decoration.

The painter who is distinguished for noble and profound conceptions; who, by means of a perfect delineation, and colours more capable of fixing the attention than dazzling the eye, conveys to the spectators the sentiments with which he himself was inspired; who animates them with his genius, and makes a lasting impression on their minds; this artist is a poet, and worthy to share even in the glories of Homer.

It is in forming this great idea of his art that the painter becomes himself great.

But if he seek only to please or astonish by the illusion of colours, he must rest contented with the secondary merit of flattering the eye with the variety and opposition of tints, or of making an industrious assemblage of a great multiplicity of objects. It is in painting as it is in poetry. The man who clothes trivial or common ideas in verse, exercises the profession of twisting syllables into a certain measure. The poet who clothes in good verse, ideas and sentiments that are merely agreeable, professes an agreeable art. But he who by the magic of verse, of ideas, of imagery, or of colours, adds sublimity to the sublime objects of nature, is a great poet and a great painter. He deserves the crown which the nations have decreed to Homer, Virgil, Milton, Raphael, and the statuary who modelled the ancient Apollo. It is reasonable to place in the same class those who have expressed the same ideas, whether it be in verse or in colours, on brass or on marble. The painter and statuary, who excel in their professions, deserve all the respect due to genius: they are of the number of those men whom nature, sparing of her best gifts, grants but occasionally to the inhabitants of the earth. If they are sublime, they elevate the human race; if they are agreeable only, they excite those sweet sensations necessary to our happiness.

In laying before our readers a succinct account of this noble art, we shall, first, give the history of painting, including its rise, progress, and decline, in ancient and modern times; an account of the schools, and of the different merits of painters; and a comparison between the ancient and modern painting. Secondly, we shall lay down the principles of the art, and the order in which the artist conducts his studies. Thirdly, we shall enumerate the different classes of painting, with observations on each. And, Fourthly, we shall treat of economical or house painting.

HISTORY.

Sect. I. *Rise, Progress, and Decline of Painting in Ancient and Modern Times.*

It is to be imagined that men must naturally, and very early, have conceived an idea of the first principles of the art of painting; the shadow of each plant and animal, and of every object in nature, must have afforded them the means of conceiving, and pointed out the possibility of imitating, the figures of all bodies. Thus the savage nations, an emblem of what men were in the infancy of society, possess the first rudiments of this art, even before those which are useful and almost necessary to existence; their naked bodies are covered with punctures of various forms, into which they infuse indelible colours. The next demand for this art, is to preserve the memory of warlike exploits. It is more natural to form some representation of an action, than to give an account of it by means of arbitrary characters. Hence the picture-writing of the Mexicans, and the more complex hieroglyphics of Egypt.

Painting consisted of simple outlines long before the expression of relievo, or the application of colour. It was

was simply drawing; and the master-pieces of painting in that rude period were not superior to the sports of children. Although occupied about a single point, it was not brought to perfection; for constant experience instructs us that men never excel in the inferior parts of an art till they are capable of carrying the whole to perfection.

After employing for a long time those simple outlines, the next step in the art of painting was to make the imitation more complete by applying colours; this was first accomplished by covering the different parts of the figure with different colours, in the same way that we colour maps; and several nations, as the Egyptians, the Chinese, and the different nations of India, have never painted in a better manner. Other nations, more ingenious and more attentive to the arts, observing that the objects of nature have relievo, have invented what is called *claro-obscuro*. The Greeks, the most ingenious, penetrating, and delicate of all, invented this part antecedent to colours; than which there cannot be a greater proof of their exquisite taste, as the glare of colours without judgment excites more admiration in the minds of the vulgar and ignorant, than the camaien or drawings of one colour executed by the most skilful artist.

These general observations concerning the gradual improvement of this art, will be best illustrated by a more particular attention to the ancient nations in which it flourished.

1 Painting among the Egyptians.

Plato, who lived 400 years before the Christian era, informs us that painting had been practised in Egypt for ten thousand years; that some of the productions of that high antiquity were in existence; and that they bore an exact resemblance to those which the Egyptians executed in his time. Without regarding the period of ten thousand years mentioned by Plato, it is reasonable to consider it as an indeterminate period, which carries us back to very remote antiquity.

The figures either in the painting or sculpture of Egypt were extremely stiff; the legs were drawn together, and their arms were pasted to their sides. It appears that their only model was their mummies, and that their skill in anatomy was derived from embalming them. They were extremely incorrect in every part of the head; they placed the ears much higher than the nose. Besides, they gave the face the form of a circle instead of an oval; the chin was short and rounded; the cheek excessively so; and they turned upwards the corners of the mouth and eyes. Many of these faults may be ascribed to the formation of the human face in Egypt; but the placing of the ears could only be founded in caprice or ignorance.

The exactness of the Egyptian proportion is much celebrated; but although we grant that they observed the proper length of the different parts of the human body, they were still defective artists, since they did not observe the breadth, and were moreover ignorant altogether of the shape and size of the muscles. Works converted to religious purposes chiefly occupied the Egyptian painters. They had figures for imitation from which they would not depart, and those figures were monstrous; the bodies of animals with the heads of men; the bodies of men with the heads of animals: or if the figure was more agreeable to nature in its parts, yet it was so deformed and imaginary, as to have nothing similar to it as a whole in the creation of God.

The monuments of Egyptian painting with which we are best acquainted (says Winklemann) are the chests of mummies. These works have resisted the injuries of time, and are still submitted to the examination of the curious. The white, made of white lead, is spread over the ground of the piece; the outlines of the figure are traced with black strokes, and the colours are four in number; namely, blue, red, yellow, and green, laid on without any mixture or shading. The red and blue prevail most; and those colours seem to have been prepared in the coarsest manner. The light is formed by leaving those parts of the ground, where it is necessary, covered with the white lead, as it is formed by the white paper in some of our drawings. This description is sufficient to convince us that the whole art of painting in Egypt consisted in colouring: but every person knows, that without tints and the mixture of colours painting can never arrive at great perfection.

In Upper Egypt there seems to have existed a kind of colossean painting, which has never been examined, except by travellers who were no great critics in the art. Winklemann had some reason to express a desire that those remains of antiquity, with regard to the manner of working, the style, and the character, had been accurately explored. Walls of 24 feet in height, and pillars of 32 feet in circumference, are wholly covered with those colossean figures. According to Norden they are coloured in the same manner with the mummies: the colours are applied to a ground prepared in manner of fresco; and they have retained their freshness for many thousand years. Winklemann adds, that all the efforts of human skill and industry could make as little impression on them as the injuries of time. His enthusiasm for antiquity has perhaps led him into this extravagant exaggeration.

It appears that the great employment of the Egyptian painters was on earthen vessels, on drinking cups, in ornamenting barges, and in covering with figures the chests of mummies. They painted also on cloth; but painting, as an industrious occupation, supposes a workman not an artist: the decoration of temples, house painting, and that of the figures relative to religion, are to be considered only in this point of view. The workmen in Russia who paint our Saviour holding the globe in one hand, and blessing the people with the other, are not members of the imperial academy of fine arts.

Pliny informs us that the Egyptian artists painted also the precious metals; that is to say, they varnished or enamelled them. It is doubtful what this art was, but most probably it consisted in covering gold or silver with a single colour.

The Egyptians are supposed to have continued this coarse style till the reign of the Ptolemies.

2 In Persia.

The Persians were so far from excelling in the arts, that the paintings of Egypt were highly esteemed among them after they had conquered that country.

The carpets of Persia were of great value in Greece, even in the time of Alexander the Great, and these were adorned with various figures; but this is no proof that they were well executed, any more than a demand for several of the Chinese productions is at present a proof of the taste of that people in the arts. It was the fabrication of the silk, and not the truth of the representation, which made the Greeks admire the carpets of the Persians.

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The Persians, as well as the Arabians, had some knowledge of mosaic work. This is only valuable when it copies, in a manner that cannot be destroyed, the works of a great master; but if the Persians had no good pictures to copy into mosaic, it was of no consequence to be able to arrange, in a solid manner, pieces of flint one beside another.

There is only one Persian painter whose name has descended to posterity; and he is preserved, not because he was a painter, but because he accommodated the ancient doctrine of the two principles to the Christian religion. Besides, it is doubted whether Manes was a Persian or a Greek, and it is still less known whether he was a painter. He is praised in Asia for drawing straight lines without a ruler.

The modern Persians have made no kind of progress in the arts. The emperor Schah Abbas, wishing from caprice to be instructed in drawing, was obliged to have recourse to a Dutch painter who happened to be in his dominions.

3 In India and Thibet.

The modern Persians paint on cloth, and the artists in India are their rivals in this branch of industry; but their paintings are purely capricious. They represent plants and flowers which have no existence in nature; and their only merit consists in the brightness and the strength of their colours.

Besides this, the art in India, as it was in the most remote antiquity, is confined to monstrous figures connected with their religion, animals not to be found in the world, and idols with a multitude of arms and heads, which have neither exactness in their forms nor proportions. See POLYTHEISM.

The paintings of Thibet discover great patience in the artist, and are remarkable for the fineness of their strokes. Their painters might dispute with Apelles and Protogenes for extreme tenuity of pencil; but it is in this alone, without any regard to the art, in which their merits consists.

Some of the idols in Thibet are executed in a certain style of relievo; but those productions are not only imperfect, they are also so destitute of beauty as to forbid every hope of excellence in the art. The same thing may be observed with regard to many of the eastern nations; they seem to have that want of style which would for ever condemn them to mediocrity, even if they should happen to arrive at it.

4 In China.

An obscure Italian painter named *Giovanni Ghirardini*, who travelled into China, whose judgment is more to be depended on in an art which he practised than that of other travellers, declares that the Chinese have not the least idea of the fine arts; and this opinion is confirmed by every thing which we know of that people.

The Chinese seem not to have the smallest conception of perspective. Their landscapes have no plan, no variety in the appearance of the clouds, and no diminishing of the objects in proportion to their distance.

The great object of their painting seems to consist in making their figures as unlike nature as possible; it is a serious caricature of the human figure.

To make the art flourish, it is necessary that the artist be esteemed and rewarded. In China, there is no artist so poorly paid as the painter.

The ignorant admire the brightness and purity of their colours; but simple colours appear always bright and pure: The difficulty of the art consists in melting them into one another in such a manner that the mixture shall not be perceived. It must at the same time be confessed, that their natural colours are more brilliant than ours; but if there be any merit in this, it is to be ascribed to their climate, not to their ability.

A Jesuit missionary, who in his youth had been a grinder of colours, was raised to the greatest eminence as a painter in the Imperial court of China, and Raphael himself was never so much respected. The Chinese battles sent from that country to Paris to be engraved, are the work of the Jesuits; and except they were done by the Chinese themselves, it is impossible to conceive that they could be worse executed.

The Chinese, like other eastern nations, have a few simple strokes which they repeat in all their variety of figures. In the figures on the earthern ware, they discover no knowledge of forms, no expression of the most conspicuous muscles, and no idea of proportion. And in all the paintings of China, anatomy seems to bear no relation to the art. Some heads done by a Chinese painter have a sort of resemblance to nature, but they are in a low and vicious taste: The fulness of the drapery conceals the parts in such a manner that they do not seem to exist under it. Sculpture in China is in a state of no great perfection, but at the same time it is better executed than their paintings.

In Etruria.

The ancient inhabitants of Etruria, now called *Tuscany*, were the first who connected the arts with the study of nature. In some of their monuments which still remain, there is to be observed a first style, which shews the art in its infancy; and a second, which, like the works of the Florentine artists, shows more of greatness and exaggeration in the character than precision or beauty.

Pliny says that painting was carried to great perfection in Italy before the foundation of Rome; perhaps he means in comparison with the infancy of the art in Greece at that period; but it appears that even in his time the painters of Etruria were held in great reputation.

The only Etrurian paintings which remain, have been found in the tombs of the Tarquins. They consist of long painted frizes, and pilasters adorned with huge figures, which occupied the whole space from the base to the cornice. These paintings are executed on a ground of thick mortar, and many of them are in a state of high preservation.

6 In Campania.

Winklemann is of opinion, that the Greek colonies established at Naples and Nola, had at a very early period cultivated the imitative arts, and taught them to the Campanians established in the middle of the country. This learned antiquarian considers as works purely Campanian, certain medals of Capua and Teanum, cities of Campania into which the Greek colonies never penetrated. The head of a young Hercules, and the head of a Jupiter, according to Winklemann, are executed in the finest manner. It is still a question, however, in the learned world, whether these medals owe their existence to Carthage or to Campania.

"But there has been discovered (adds Winklemann) a great number of Campanian vases covered with painting. The design of the greatest part of these vases (says he) is such, that the figures might occupy a distinguished

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guished place in a work of Raphael. Those vases, when we consider that this kind of work admits of no correction, and that the stroke which forms the outline must remain as it is originally traced, are wonderful proofs of the perfection of the art among the ancients." Winklemann had an opportunity of examining a very fine Campanian vase, on which was painted a burlesque representation of the loves of Jupiter and Alcmena. But as this must have been derived from some fragments of a Grecian comedy, the Count de Caylus is persuaded that the Campanian vases are of Greek origin.

7
Among the Greeks.

Although the history of Greek painting be more fully known than that of the same art among the barbarous nations, it is nevertheless involved in much obscurity. Pliny is almost the only author who has preserved the materials of its history; and he complains, that on this occasion the Greek writers have not discovered their usual precision. They place, says he, the first painter, of whom they speak, in the 90th Olympiad, 624 years before the Christian era. It is certain that painting in dry colours existed at the time of the siege of Troy, or at least when Homer wrote the account of it. The buckler of Achilles is a sufficient proof that the Greeks were then acquainted with the basso relievo, a kind of sculpture which bears a near affinity to painting.

In the Iliad, Helen is represented as working at a tapestry, whereon she figured the numerous combats of which she was the cause. When Andromache was informed of her husband's death, she was occupied in representing on tapestry flowers of various colours. From these facts, it is certain that painting was not confined to simple strokes, nor even to the camaieu; and hence it is reasonable to conclude, that what is called *lineary painting* was practised long before the time of Homer. Polygnote of Thasos, who lived about 420 years before the Christian era, was the first painter of any eminence in Greece. Pliny informs us that he was the first who clothed his female figures, who varied the colours of the different parts of their dress, or who opened their mouths in such a manner as to shew their teeth. Aristotle, who flourished in a subsequent period, allows this painter to have excelled in expression. But the art of painting may be still considered in its infancy in Greece, till about 400 years before the Christian era, when Zeuxis and Parrhasius flourished. In the contest between these eminent painters, Zeuxis declared himself to be overcome, because in a cluster of grapes which he painted he had deceived the birds; whereas Parrhasius in a curtain which he executed deceived his rival. The principal works of Zeuxis are his Penelope, in which, according to Pliny, he appears to have expressed the manners of that princess; a Jupiter surrounded by the gods; a Hercules strangling the serpents in the presence of Amphitrion and Alcmena; an Helen, and a Marsyas bound. From this enumeration of these works, and from the fame which they have acquired, it is evident that the difficult parts of the art and those which in the execution render it estimable, were now begun to be studied. By Apelles, Protogenes, and Euphranor, it was carried to the greatest height of perfection. Grace, and symmetry, and proportion, and illusion, were now added by the greatest masters to the noblest objects of nature.

We have already seen, that before the foundation of Rome the arts were cultivated in Etruria. They were also early introduced into Latium; but whether that country employed its own artists or those of Etruria, remains altogether uncertain. One need not be astonished, that at a period when the arts were in their infancy in Greece, they were raising statues to their kings in Rome: but at that period all their artists were Etrurians or Latins; and when they conquered Italy, they made all the nations of it as barbarous as they were themselves.

8
Among the Romans.

In the year 259 from the building of the city of Rome, and 494 years before the Christian era, Appius Claudius consecrated a number of shields in the temple of Bellona, which contained in basso relievo the portraits of his family. This example was followed; and in process of time it was common among the Romans to place those images in private houses. The execution in basso relievo is a proof that they had an idea of painting, at least with one colour. As long as the Romans employed artists of other nations, they had little desire to cultivate the arts; but towards the year of Rome 450, and 303 years before Christ, one of the Fabii thought it no discredit to a noble family to employ himself in painting. He painted the temple of Safety; and his works remained till that temple was destroyed by fire, in the reign of Claudius. It is worthy of remark, that the same man was the first painter and the first historian in his country.

The example of Fabius, surnamed *Pictor* from his profession, did not excite his fellow citizens to imitation. A century and a half elapsed before the tragic poet Pacuvius, nephew of Ennius, painted the temple of Hercules in the *forum boarium*. The glory which he had acquired by his dramatic works shed some lustre on the art, which he condescended to exercise; but did not confer on it that respect which could recommend it to general practice. The paintings of Fabius were the works, or rather the recreations of his youth; those of Pacuvius, the amusements of his old age: but painting is a difficult art, which requires the whole attention, and which can never be prosecuted with success, except those who love it are solely devoted to the performance.

It appears that there were no eminent painters at Rome till the time of the emperors; but as the national spirit was changed, the profession of the fine arts acquired more respectability. The Romans, during the time of the republic, were animated with the spirit of liberty and the desire for conquest. When these two passions were weakened, the love of the arts obtained among them. As a proof of this it is sufficient to say, that Nero himself gloried in being an artist. A colossean picture of 120 feet was painted at Rome by the command of this emperor, which was afterward destroyed by lightning. The name of the painter is not recorded, and there are various opinions concerning the merit of the performance; but the thing chiefly worthy of observation is, that this is the only painting on cloth mentioned by ancient authors.

9
Of the modes of painting among the ancients.

The paintings of the ancient artists were either moveable, or on the ceilings or compartments of buildings. According to Pliny, the most eminent were those who painted moveable pictures. The latter were either on fir wood, larch, boxwood, or canvas, as in the colossean picture

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picture mentioned above, and sometimes on marble. When they employed wood, they laid on in the first instance a white ground. Among the antiquities of Herculaneum are four paintings on white marble.

Their immoveable paintings on walls were either in fresco or on the dry stucco in distemper. Indeed all the ancient paintings may be reduced to, *first*, fresco painting; *secondly*, water colour, or distemper painting on a dry ground; and, *thirdly*, encaustic painting.

The ancient fresco paintings appear to have been always on a white stucco ground, the colours inlaid very deep, and the drawing much more bold and free than any similar performance of modern art. The outlines of the ancient paintings on fresco were probably done at once, as appears from the depth of the incision and the boldness and freedom of the design, equal to the care and spirit of a pencilled outline.

In general the ancients painted on a dry ground even in their buildings, as appears from the Herculaneum antiquities, most of which are executed in this manner. At Rome and Naples, the first (deepest) coat is of true puzzolana, of the same nature with the *tarras* now used in mortar required to keep out wet, about one finger thick; the next of ground marble or alabaster, and sometimes of pure lime or stucco, in thickness about one third of the former. Upon this they appear to have laid a coat of black, and then another of red paint; on which last the subject itself was executed. Such seems to have been their method of painting on walls; but in their moveable pictures, and in the performance of their first artists, and where effect of shade and light were necessary, they doubtless used white.

The colours employed they seem to have mixed up with size, of which they preferred that made by boiling the ears and genitals of bulls. This appears to have made the colour so durable and adhesive, that the ancient paintings lately found bear washing with a soft cloth and water; and sometimes even diluted aquafortis is employed to clean their paintings on fresco. Pliny says that glue dissolved in vinegar and then dried, is not again soluble.

What the encaustic painting of the ancients was, has been much disputed. From the works of Vitruvius and Pliny, it appears evidently that it was of three kinds.

First, Where a picture painted in the common way, was covered with a varnish of wax melted, diluted with a little oil, and laid on warm with a brush.

Secondly, Where the colours themselves were mixed up with melted wax, and the mixture used while warm. And,

Thirdly, Where a painting was executed on ivory by means of the *cestrum* or *viriculum*.

Some experiments on this last method by Mr Colebrook may be found in the Phil. Trans. vol. li. and more particular directions in Muntz's Treatise on Encaustic Painting.

It appears from ancient writings of the best authority, that in the earliest and purest times of this art, the painters used few colours, perhaps not more than four. "The paintings of the ancients (says Dionysius Halicarnasseus) were simple and unvaried in their colouring, but correct in their drawing, and distinguished by their elegance. Those which succeeded, less correct in their drawing, were more finished, more varied in their light and shades, trusting their effect to the multitude of their colours." But no certain conclusion can be drawn, that the more early among the great painters of the ancients, such as Apollodorus, Zeuxis, Timanthes, &c. had only four different colours, merely because they did not use them. On the contrary, it may be conjectured with some degree of probability, from their chasteness in design, and from the complaints Pliny makes of the gaudy taste of the Roman painters, that the Greeks in general were *designedly* chaste in their colouring, and not so merely from necessity, at least about the time of Zeuxis and Apelles; for the former could not have painted grapes so naturally as he is said to have done with four colours only; and the rebuke given by the latter to one of his scholars who had painted a Helen very gaudily, is a confirmation of these observations. "Young man (says Apelles), not being able to make her beautiful, you have made her rich." 10

Of white colouring substances, the ancients had white lead variously prepared, a white from calcined egg shells, and preparations from cretaceous and argillaceous earths. The moderns, in addition, have magistery of bismuth, little used; and *ought* to have the calces of tin and zinc. The colours used by the ancients.

Of *blacks*, the ancients had preparations similar to lamp, ivory, blue, and Francfort black; also to Indian ink, and common writing ink; and they used, what we do not, the precipitate of the black dyers vats.

The ancients possessed a species of *vermilion* or fine cinnabar, a coarser cinnabar, red lead, various earths burnt and unburnt, apparently similar to our red ochre, Venetian red, Indian red, Spanish brown, burnt terra de Sienna, and scarlet ochre; they had also a substance alike in colour and in name to our dragon's blood.

The yellow pigments of the ancients were generically the same with our orpiments, king's yellow, Naples yellow, &c. They did not possess turpeth-mineral, mineral yellow, or gamboge; nor do they appear to have known of gall-stone as a pigment.

Of blue paints they had preparations from the lapis cyanus and lapis armenius. Indigo they had, and perhaps bice and smalt; for they made blue glass, but whether from some ore of cobalt or of wolfram must be uncertain: they had not Prussian blue, verditer, or litmus, which we have. We do not use the blue precipitate of the dyers vats, or mountain blue, which they certainly employed.

Of green colours they had verdegrise, terre verte, and malachite or mountain green. The latter is not in use among us. Sap-green, green verditer, and Scheele's green, appear to have been unknown to them: like us, they procured as many tints, as they pleased from blue and yellow vegetables.

We have no original *purple* in use: that from gold by means of tin, though very good when well prepared, is too dear perhaps, and unnecessary. Their purple was a tinged earth. Their orange or sandarac (red orpiment) we also possess. Hence there does not appear to have been any great want of pigments, or any very material difference between the colours they used and such as we generally employ. Perhaps the full effect of colouring may be obtained without the use of exceeding brilliant pigments, depending chiefly on the proportion and opposition of tints.

The

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11
Whether the ancients painted in oil.

The ancients could not know any thing about the spirit varnishes, distillation being a modern invention; but they were undoubtedly acquainted with the use of the better oil varnishes, that is, with the use and effect of resinous gums dissolved in boiling inspissated oils.

One of the best preserved mummies in the British Museum has an astonishing brightness of colours on the outside of the coffin. Thousands of years have not impaired them; they are as fresh as if they had been laid on yesterday.

The chalk ground, and the excellency of the colours, some of which imply a good deal of chemical and metallurgical knowledge, do not sufficiently account for their splendour and freshness: it must be owing to other circumstances; either to the mixture of shining colours, or to a hard glossy skin, which visibly covers them all over.

From an accurate examination of one of those mummies belonging to the university of Cambridge, it appeared, that the varnish which covered the colours could not be dissolved, or in the least affected by common water; and that it equally resisted the dissolving power of the strongest spirits: hence it is reasonable to conclude that the coffins of the mummies were not covered with size, white of eggs, simple gums, or any preparation of wax, but with a fine transparent oil varnish. It was discovered at the same time, that the colours themselves were not prepared or mixed with oil; for where the external glossy skin was damaged, broken, or rubbed off, even common water would wash the colours away, and affect the chalk ground under them.

Pliny has described the general and particular effects of the varnish of Apelles, under the name of *atramentum*, so indistinctly, that nobody can distinguish the thing or the mixture he is speaking of. He has mentioned the shining glossy skin of the varnish which excites the brightness of the colours, and preserves them against dust; he observed, that this skin was laid on so thin, that it could not be discerned at any distance: nor was he less accurate in reporting the particular effects of that mixture which Apelles made use of; it harmonized and lowered the tone of the brightest florid colours in an imperceptible manner, and the whole appeared as if it had been seen through isinglass. The chemists and connoisseurs are fully of opinion, that no liquid substance or mixture of any kind is fit to produce these effects besides the oil varnishes: and if there are not, Apelles and the Greeks were certainly acquainted with those varnishes: a fact which might be strongly urged in behalf of their knowledge of oil colours.

The black outlines of the figures on the most ancient Greek paintings yet extant, that is, on Etruscan vases, are so sharp, so thick, and drawn in so easy and masterly a manner, that one cannot help looking upon them as having been drawn in oil colours. Had they been in distemper or water colours on the red clay ground on which they are applied, they would have been imbibed and soaked into it. Our china and enamel painters prepare and apply their colours with spike or other liquid oils; and the Greek masters seem to have done the same, unless they should appear to have burnt their vases before they painted them, or to have used a mixture of dissolved wax or gum for giving a body to their colours, which might have answered the same ends as oils. And this is the more probable, as there is some reason to believe that these vases went through two different fires, that of baking them, and that of smelting or burning in their colours.

The Greek and Roman paintings that have been preserved or discovered at Rome and Herculaneum do not countenance the supposition of oil colours; at least Turnbull and the academists at Naples, who have described the royal collection at Portici, Cochin, and many other authors who have seen and described them, do not hint any thing of that nature. On the other hand, Vitruvius, who has left us so many valuable notices of the ancient arts, acquaints us, that there was a kind of painting which absolutely required a mixture of oil: And Pliny, to the same purpose, expressly says, "Sun and moon shine are inimical and obnoxious to red lead. The remedy is to apply the red wax when hot and melted *with some oil* on the well dried walls, which is to be done with brushes."

From these observations, the evidence which the ancients have given us in behalf of themselves, and of their knowledge of oil painting, may be summed up in few words.

Their having been acquainted with the white chalk ground, which many modern masters have used for oil painting on boards, proves no more than that the ancients might have done the same.

The oil varnishes used by the Egyptians and by Apelles might have brought them to the discovery of oil painting; but as it appears both from mummies and from the works of Pliny, that their colours were not prepared and mixed with that varnish, and as it is plain rather that this varnish was externally laid over the finished pictures; no other conclusion can be drawn, except that they were within sight of the discovery, and that it is a matter of wonder that they should not have laid hold of it.

The outlines of the old Greek or Etruscan vases are merely fallacious appearances.

The old Greek and Roman paintings on walls and stones are either painted in distemper and fresco, or they have not been sufficiently examined.

The oil used in the coarser wax and wall paintings proves at most that experiments had been tried with oils: but we have no direct proofs of oil painting having been understood or used by the Egyptians, Greeks, or Romans, and that, however great their skill or ingenuity, they might very well have been within sight and reach of the discovery, and nevertheless have missed it.

12
Rise, progress, and decline, of modern painting.

The art of painting was revived in Europe about the end of the 13th or beginning of the 14th century. The human mind, however, plunged in profound ignorance, was destitute of every principle of sound philosophy which might enable it to determine on the objects of the arts; and of consequence the painters contented themselves with works adapted to the general taste, without beauty and without proportion. In Italy, where the first attempts were made, they were employed in representing the mysteries of the *passion*, and subjects of a similar nature, on the walls of chapels and churches. Their labours were directed to a vast number of figures, rather than to the beauty and perfection of each; and the art in more modern times has always preserved somewhat of this absurd fault which it contracted at that early period. The artist in our times is not, like those in Greece, at liberty to devote

devote his talents only to men of knowledge and discernment; he is constrained to please those who are rich, and very frequently those who are ignorant. Instead of proposing to himself the perfection of the art as the great object of his pursuit, he must rest his success and character on the facility of his operation and the abundance of his works.

Painting did not long continue in the imperfect condition in which it was left by those who first cultivated it among the moderns. It was natural that their successors should endeavour to surpass them, by joining some degree of theory to the barbarous practice they had adopted. The first thing which they discovered, or rather which they revived after the manner of the ancients, was perspective. This made the artists capable of expressing what is called *foreshortening*, and of giving more effect and more truth to their works.

Dominique Ghirlandaios, a Florentine, was the first who enriched the style of his composition by grouping his figures, and who gave depth to his pictures, by distinguishing, by exact gradations, the spaces which his figures occupied; but his successors have far surpassed him in boldness of composition.

Leonardo da Vinci, Michael Angelo, Giorgian, Titian, Bartholomew de St Marc, and Raphael, flourished about the end of the 14th century. Leonardo da Vinci was the inventor of a great many details in the art: Michael Angelo, by studying the ancients, and by his knowledge of anatomy, arrived at great elegance in drawing the outlines of his figures: Giorgian enriched the art in general, and gave greater brilliancy to his colours than his predecessors: Titian, by a careful imitation of nature, made great proficiency in the truth and perfection of his tones: Bartholomew de St Marc studied particularly the part of drapery, and discovered the claro obscuro, the best manner of giving drapery to his figures, and of making the naked to be felt even where they were covered: Raphael, endowed with a superior genius, began with studying carefully all his predecessors and all his contemporaries. He united in himself all the excellencies which they possessed; and formed a style more perfect and more universal than any painter who went before or who has succeeded him. But while he excelled in every part of the art, he was chiefly superior in those of invention and composition. It is probable that the Greeks themselves would have been filled with admiration if they had beheld his chief pieces in the Vatican, where to the greatest abundance of paintings is joined so much perfection, and purity, and ease.

After painting had arrived at the greatest perfection among the Greeks by the exertions of Zeuxis and Parrhasius, Apelles found nothing to add to the art except grace; in the same manner among the moderns, after Raphael had appeared, grace was the only thing wanting to the art, and Corregio became the Apelles of Europe. Painting was by him carried to the highest degree among the moderns; the taste of the best critics and the eye of the vulgar were equally gratified.

After these great masters a considerable interval elapsed till the time of the Caracci. Those artists born at Bologna, by studying the works of their predecessors with great care, and particularly those of Corregio, became the first and the most celebrated of their imitators. Hannibal possessed a very correct design, and united somewhat of the ancient style to that of Lewis his brother; but he neglected to inquire into the intricate principles and philosophy of the art. The pupils of the Caracci formed a school after their manner; but Guido, a painter of an easy and happy talent, formed a style altogether graceful, and rich, and easy. Guershen formed after Caravagio, or invented himself, a particular style of the claro-obscuro, composed of strong shades and vivid oppositions.

Peter de Cortona succeeded those great imitators of their predecessors and of nature; who finding it difficult to succeed in that kind of painting, and having besides great natural abilities, applied himself chiefly to composition or arrangement, and to what the artists call taste. He distinguished invention from composition; appeared not to have attended to the former, but chiefly to those parts which are most prominent in the picture, and to the contrasting of groups. It was then that the practice was introduced of loading pictures with a great number of figures, without examining whether or not they agreed to the subject of the history. The ancient Greeks employed a very small number of figures in their works, in order to make the perfection of those which they admitted more evident. The disciples or imitators of Cortona on the other hand, have sought to conceal their imperfections by multiplying their figures. This school of Cortona is divided into many branches, and has changed the character of the art. The multiplication of figures, without a judicious and proper choice, carried back the art of painting to that point where the first restorers of it among the moderns had left it; while at the same time the disciples of Cortona were enabled to give to this first condition of the art a greater degree of perfection than the first artists.

About the middle of the 17th century flourished at Rome Carlo Maratti, who, aiming at the greatest perfection, carefully studied the works of the first painters, and particularly those of the school of the Caracci. Although he had already studied nature, he discovered by the works of these artists that it is not always proper to imitate her with a scrupulous exactness. This principle, which he extended to every part of the art, gave to his school a certain style of carefulness, which however is considerably degenerated.

France has also produced great masters, particularly in the part of composition; in which Poussin, after Raphael, is the best imitator of the style of the ancient Greeks. Charles le Brun and many others distinguished themselves for great fertility of genius: and as long as the French school departed not from the principles of the Italian school, it produced masters of great merit in the different branches of the art.

Mengs, from whom this account is taken, is not deceived when he declares the art of painting to have degenerated in France after Le Brun; but he seems to be mistaken in giving the imitation of the works of Rubens found at Paris as the cause of this decay. It appears from this opinion, that the recent French school was not well known to him. The French, indeed, if we may believe their own authors, were never much occupied in the imitation of Rubens; and they have for a long time despised him. But the perfection of the dramatic art in France, the dress of their actors, the magnificence and manners of the court, have contributed very much to the decay of painting.

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painting. Instead of forming their taste on the beautiful simplicity of nature, their painters studied the gestures and the attitudes of comedians, the fopperies of women of fashion, the affected airs of courtiers, the pageantry of Versailles, and the magnificence of the opera. Mengs says, "that the French have formed a national style, of which ingenuity and what they call *esprit* are the discriminating qualities; that they have ceased to introduce Greek, Egyptian, Roman, or barbarian personages into their paintings; and that after the example of Poussin, they content themselves with figures altogether French, as if it were their intention to hand down to posterity that such a nation once existed.

Since, according to the confession of Mengs, their figures are altogether French, there is no reason to believe that the French painters have imitated Rubens, whose works are marked much more strongly than those of his master Æneus with the Flemish character. The truth is, that their painters, like Cortona and Maratti, have crowded their pictures with a great number of figures; have grouped them in a manner most calculated to strike the senses; have been more intent on agreeable artifices than expression and beauty; and, finally, that they have borrowed the manners of the court and theatre.

The first masters of the great schools of painting, with the ancients and nature for their guides, and their genius for their support, carried every part of the art to the greatest height of perfection. Those who followed them, and who had the example of their predecessors in addition to the first sources of truth and beauty, did by no means arrive at the same excellence. The Caracci in their school, Paul Veronese, and all the painters of his time, Vandyke, and all those who exercised the art in Italy, in Flanders, and in France, supported it with great brilliancy. But soon after the number of artists was multiplied; and slavishly copying men of inferior talents, they produced works of an inferior nature. Some wanting to be colourists, their pieces were exaggerated; others affecting simplicity, became cold and insipid. At this period of the art, men of real abilities, and covetous of fame, who wished to rise superior to the mediocrity of the times, seem not to have taken the road of truth and nature. They affected a style of pompous preparation, and annexed a kind of merit to the expert management of the pencil. The affected forms of Cortona and of his pupils, the fantastical attitudes and the poignant effects of Piazetta, and in short the ingenious contrivances of the last masters of the French school, are decided proofs of this increasing bad taste.

It appears, that for some time past greater pains have been taken to form men for the art than to encourage those who possess the talent. In consequence of this ruinous practice, schools for drawing, very different from those formed by able painters, have been exceedingly multiplied; and these give the elements according to an uniform system, by which the mind is laid under a regular restraint at the very threshold of the profession. This evil is productive of two inconveniences; it gives middling painters, and it multiplies them to that degree, as to hasten the downfal and bring into contempt the art itself.

The particular reputation of the Italian painters furnishes another reason for the decline of the art. The first painters of that country were few in number; they were honoured, and they deserved to be honoured. Their distinguished reputation has conferred a value on the general paintings of their countrymen. The desire of possessing taste, or of being thought to possess it, had led the rich and the ignorant of all nations to give a preference to the Italian market. Necessity, in this case, would multiply the painters; and their abilities must bear a pretty exact proportion to the discrimination of those who give the price.

The decline of painting has also arisen from the despotism which for some time reigned in the academic societies. In fact, these have often been ruled by men who would force every exertion of genius into their peculiar tract of operation. If they required such or such merit of execution, the first principles of the art were neglected for that peculiar excellency. In this manner the schools were absolute in behalf of design as long as statuary was held in chief estimation. The artist, whose abilities and inclination led him to colouring, was obliged to abandon a pursuit which could be of no service to him, and devote himself to that for which he was not qualified by nature. On the other hand, if the instructions of the schools be confined to colouring, a mind disposed to the choice and exactness of forms will find no encouragement, and be for ever lost to the art. In this manner the ignorance of those who wish to be connoisseurs, and the narrow views of those who pretend to direct the general taste, have equally contributed to the decline of the arts.

Sect. II. *Of the Schools.*

A School, in the fine arts, denominates a class of artists who have learned their art from a certain master, either by receiving his instructions, or by studying his works; and who of consequence discover more or less of his manner, from the desire of imitation, or from the habit of adopting his principles.

All the painters which Europe has produced since the renovation of the arts are classed under the following schools: the school of Florence, the school of Rome, the school of Venice, the Lombard school, the French school, the German school, the Flemish school, the Dutch school, and the English school.

13 School of Florence.

This school is remarkable for greatness; for attitudes seemingly in motion; for a certain dark severity; for an expression of strength, by which grace perhaps is excluded; and for a character of design approaching to the gigantic. The productions of this school may be considered as overcharged; but it cannot be denied that they possess an ideal majesty, which elevates human nature above mortality. The Tuscan artists, satisfied with commanding the admiration, seem to have considered the art of pleasing as beneath their notice.

This school has an indisputable title to the veneration of all the lovers of the arts, as the first in Italy which cultivated them.

Painting, which had languished from the destruction of the Roman empire, was revived by Cimabue, born of a noble family in Florence in the year 1240. This painter translated the poor remains of the art from a Greek artist or two into his own country. His works, as may easily be imagined, were in a very ordinary style, but they received the applause and admiration of his fellow-citizens; and if Cimabue had not found admirers, Florence in all probability

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probability would not have been honoured with Michael Angelo. The number of painters became soon so considerable in Florence, that in the year 1350 they established a society under the protection of St Luke.

Massolino, towards the beginning of the 15th century, gave more grandeur to his figures, adjusted their dress better, and shed over them a kind of life and expression. He was surpassed by Massacio his pupil; who first gave force, animation, and relievo, to his works.

Andrew Castagna was the first Florentine who painted in oil. But Leonardo da Vinci and Michael Angelo, contemporary painters, were the glory of the school of Florence. Michael Angelo was superior to Leonardo in grandeur, in boldness of conception, and in knowledge of design; but Leonardo was superior to him in all the amiable parts of the art. Leonardo, possessed of a fine imagination, and full of sensibility, devoted himself in painting to express the affections of the soul; and if, in this sublime branch of the art, he was afterwards surpassed by Raphael, he had at least the glory not only of exceeding all the painters who went before him, but of pursuing a path which none of them had attempted. His design was pure and neat, and not wholly destitute of greatness. He never went beyond nature, and he made a good choice of objects for imitation.

Michael Angelo, less formed to experience sweet affections than vehement passions, sought in nature what the strength of man might accomplish, not that which constitutes beauty. He delighted in being great and terrible, more than in graceful and pleasant attitudes. Well acquainted with anatomy, he knew more exactly than any other artist in what manner to express the joining of the bones of the body, and the office and insertion of the muscles: but too eager to display his knowledge of anatomy, he seems to have forgotten that the muscles are softened by the skin which covers them; and that they are less visible in children, in women, and in young men, than in confirmed and vigorous manhood. "In his figures (says Mengs) the articulations of the muscles are so easy and free, that they appear to be made for the attitude in which he represents them. The fleshy parts are too much rounded, and the muscles are in general too large, and of too equal strength. You never perceive in his figures a muscle at rest; and although he knew admirably well how to place them, their action is very frequently inconsistent with their situation."

"He did not possess (says Sir Joshua Reynolds) so many delightful parts of the art as Raphael; but those which he had acquired were of a more sublime nature. He saw in painting little more than what might be attained in sculpture; and he confined it to exactness of form and the expression of passions."

He informs us, in one of his letters, that he modelled in earth or wax all the figures which he intended to paint. This method was familiar to the great painters of his time, and ought never to be abandoned. It appears, that in representing them in this manner in relievo, the painter can imitate them much more exactly than when they are drawn with a crayon or pencil on a plain surface.

"Michael Angelo (continues Sir Joshua Reynolds) never attempted the lesser elegancies and graces in the art. Vasari says, he never painted but one picture in oil; and resolved never to paint another, saying it was an employment only fit for women and children.

"If any man had a right to look down upon the lower accomplishments as beneath his attention, it was certainly Michael Angelo; nor can it be thought strange, that such a mind should have slighted, or have been withheld from paying due attention to, all those graces and embellishments of art which have diffused such lustre over the works of other painters."

14 Roman school.

Ancient Rome, rich with the works brought from Greece, or finished in its own bosom by Grecian artists, handed down in its ruins the remains of that glory to which it had been elevated. It was by the study of these remains that the modern artists were formed; they derived from them the knowledge of design, the beauty of exquisite forms, greatness of style, and justness of expression, carried to that length only which did not affect the beauty of the figure. From them also they derived the principles of the art of drapery; and they followed these principles even while they made the drapery of modern paintings more large and flowing than what was practised by the ancient sculptors. The Roman school was altogether devoted to the principal parts of the art, to those which require genius and vast conceptions; and was no farther occupied with colours than what was necessary to establish a difference between painting and sculpture, or rather between painting varied with colours and in claro-obscuro.

Raphael Sanzio, born at Urbino in 1483, and scholar to Pietro Perugeno, was the undoubted founder of this school. His first manner was that of Perugeno his master; but he travelled twice to Florence to study the great artists who flourished in that city.

It was fortunate for Raphael, says Mengs, that he was born, in what he terms the infancy of the art, and that he formed himself by copying nature before he had access to see the works of any great master. He began by studying, with great exactness, the simple truth in his figures. He was then ignorant that any choice was necessary; but he saw the works of Leonardo da Vinci, of Massacio, and of Michael Angelo, which gave his genius a new direction. After this he perceived that there was something more in the art of painting than a simple imitation of truth. But the works of those masters were not sufficiently perfect to point out the best choice to make; and he continued in uncertainty till he saw at Rome the works of the ancients. Then he perceived that he had found the true models which he wanted; and in imitating them he had only to follow the natural impulse of his genius.

Habituated by his first manner to imitate nature with precision, it was not difficult to carry the same exactness into the imitation of the ancients; and it was a great advantage to him that he flourished in an age wherein the artists were not arrived at facility of execution at the expence of rigorous exactness. He never lost sight of nature; but he was instructed by the ancients in what manner she should be studied. He perceived, that the Greeks had not entered into minute details, that they had selected what was great or beautiful, and that one of the chief causes of the beauty of their works was the regularity of their proportions; he began, therefore, by carefully studying this part of the art. He saw also that the joinings of the bones, and the free play of their articulations, are the causes of all graceful movement: he therefore

Schools. fore, after the example of the ancients, gave the greatest attention to this part, and was led by these observations not to be contented with the simple imitation of nature.

His design is excellent, but neither so perfect nor so finished as that of the Greeks. He excelled in representing the character of philosophers, apostles, and other figures of that kind; but he did not equal the Greeks in ideal figures, which ought to carry the impression of divinity. His taste for design was more Roman than Greek, because he formed it chiefly on the basso-relievos which he found at Rome. On this account he had the habit of marking strongly the bones and the articulations, and labouring the fleshy parts less; but as these basso-relievos are very exact with regard to the reciprocal proportions of every member, he excelled in this part, while at the same time he did not give to his figures all the elegance of the Greek artists, nor the flexibility of articulation which is admired in the Laocoon, in the Apollo of Belvidere, and in the Gladiator.

The manners and spirit of his age, and the subjects which he most commonly treated, prevented him from reaching the ideal of the ancients. Having seldom occasion to represent figures altogether ideal, he devoted himself to purity of expression. He knew that the expression of the passions of the soul is absolutely necessary in an art which represents the actions of men, since from those affections the actions may be said truly to originate. To make figures act, and yet neglect the interior springs of action, is nothing more than a representation of automata. The attitudes and action are evident; but they appear not to act of themselves, because they are void of those principles from which alone men are supposed to act. An artist who neglects expression gives no just representation of character, even though he should take nature for his model.

Raphael's first care, when he wanted to compose a piece, was to weigh the expression; that is to say, to establish, according to the nature of the subject, the passions which were to animate the characters. All the figures, all the accessories, all the parts of the composition, were moulded to the general expression.

As he had not found examples in the ancient statues of the claro-obscuro, he was comparatively weak in this part; and if there was any thing remarkable in his distribution of light and shade, he owed it to the works of the Florentine painters. It cannot be said, however, even with regard to the claro-obscuro, that he imitated nature without taste. He delighted in what are called *masses* of light; and disposed the great lights in the most conspicuous places of his figures, whether naked or in drapery. If this method did not produce effects highly illusive, it gives his works that distinctness which makes his figures conspicuous at a distance; and this must be allowed to be an essential part of the art of painting. He did not proceed beyond this; and content with that kind of claro-obscuro which comprehends imitation, he never attempted that which is ideal.

The composition and the *ensemble* of his figures were the chief excellencies of Raphael. His philosophical mind could not be affected with objects which had not expression. He had too high an idea of painting to consider it as a mute art; he made it speak to the heart and soul: and he could only do this in subjects which required expression. If Raphael did not reach the Greek excellence, if he did not possess the art of embellishing nature in the same high degree, he saw at least, and imitated her in whatever was expressive and beautiful. "The Greeks sailed with majesty (says Mengs) between earth and heaven: Raphael walked with propriety on the earth."

"Composition is in general (says the same author) of two kinds: Raphael's is the expressive kind; the other is the theatrical or picturesque, which consists of an agreeable disposition of the figures. Lanfranc was the inventor of this last, and after him Pietro de Cortona. I give the preference to Raphael; because reason presides over all his works, or at least the greatest part of them. He never allowed himself in common ideas, and was never allured to give any thing in his accessory figures which might turn the attention from the principal object of the piece."

A history of the schools is nothing more than a history of the painters who founded them. In those two which we have already given, Michael Angelo and Raphael come readily forward to claim our attention; and therefore we cannot do better than conclude the account by the masterly contrast of these eminent painters given by Sir Joshua Reynolds. "If we put those great artists (says he) in a light of comparison with each other, Raphael had more taste and fancy, Michael Angelo more genius and imagination. The one excelled in beauty, the other in energy. Michael Angelo has more of the poetical in operation; his ideas are vast and sublime; his people are a superior order of beings; there is nothing about them, nothing in the air of their actions or their attitudes, or the style and cast of their limbs or features, that puts one in mind of their belonging to our species. Raphael's imagination is not so elevated; his figures are not so much disjointed from our own diminutive race of beings, though his ideas are chaste, noble, and of great conformity to their subjects. Michael Angelo's works have a strong, peculiar, and marked character; they seem to proceed from his own mind entirely; and that mind so rich and abundant, that he never needed, or seemed to disdain, to look abroad for foreign help. Raphael's materials are generally borrowed, though the noble structure is his own. The excellency of this extraordinary man lay in the propriety, beauty, and majesty of his characters; his judicious contrivance of composition, correctness of drawing, purity of taste, and the skilful accommodation of other men's conceptions to his own purpose."

15 Venetian school.

This school is the child of nature. The Venetian painters not having under their eyes like the Roman the remains of antiquity, were destitute of the means of forming a just idea of the beauty of forms and of expression. They copied without choice the forms of nature; but they were chiefly delighted with the beauties which presented themselves in the mixture and the variety of natural colours. Their attention not being detached from this part by any thing of greater importance, colouring was their chief object, and they succeeded in it. They did not rest contented with characterizing the objects by comparison, in making the colour proper for one of more value by the colour

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colour more proper for another; but they endeavoured still farther, by the agreement and opposition of the coloured objects, and by the contrast of light and shade, to produce a vigorous effect, to demand and fix the attention. Dominic, who was said to have perished at Florence by the jealousy of André Castagna, and who was the second Italian artist who painted in oil, had educated, before he quitted Venice, his native country, Jacques Bellin, who was remarkable for nothing but the picturesque education which he gave to Gentel and John his two sons.

Gentel, who was the eldest, painted chiefly in water colours. John contributed much to the progress of his art in painting constantly in oil, and after nature. Although he always retained great stiffness in his manner, he had less than his father or brother. Great neatness of colouring, and an approach to harmony, are evident in his works. His taste in design is Gothic, the air of his heads is sufficiently noble, his attitudes are without judgment, and his figures without expression. He had for scholars Giorgion and Titian, who deserve to be considered as the founders of the Venetian school.

Giorgion distinguished himself by a design of a better taste than that of his master; but he chiefly surpassed him in colouring. He died in his 32d year; and excited the emulation of Titian, who soon greatly excelled him

Tiziano Vecelli, known best by the name of the *Titian*, was instructed to copy nature in the most servile manner in the school of John Bellin; but when he had seen the works of Giorgion, he began to study the ideal in colouring.

The truth of history is not to be expected in his historical paintings, or in those of the artists of the same school. He seems to have paid little attention to the consistence of scene, to the costume, to expression adapted to the subject, or finally, to the accommodation of parts which characterise the works of those who have studied the ancients. He was in short a great painter and nothing more.

But although he deserves not to be placed among the most distinguished artists in point of judgment, yet he is by no means destitute of great and noble conceptions. There is often to be found among his male figures a considerable degree of grandeur: but if he has sometimes, like Michael Angelo, overcharged his design, it was more discovered in the swelling of the soft and fleshy parts than in vigour and muscular strength.

Almost entirely devoted to simple imitation, he had scarcely greater choice in the claro-obscuro than in design. He cannot be justly reproached at the same time for weakness in this particular; because in endeavouring to imitate the colours of nature, he was obliged to observe the degrees of light. And in proportion as he succeeded in the imitation of natural colours he must be less defective in the claro-obscuro; but it is not in the knowledge of this part of the art that we are to seek for the beauties of his works. These are to be found in the happy dispositions of colours both proper and local, and he carries this to the highest point of perfection.

The artists in the Florentine and Roman schools painted most commonly in water colours or in fresco; and in the exercise of their profession, instead of nature, they finished their works from their first sketches. Titian painted in oil, and finished from the objects in nature; and this practice, joined to his exquisite talents, gave the greatest truth to his colours. His being a portrait painter was also of advantage to him as a colourist. In this department he was accustomed to the colours of nature in carnations and draperies. He was a landscape-painter, and here also he took the colours from nature.

"As Titian perceived (says Mengs) that the objects which are beautiful in nature have often a bad effect in painting, he found it necessary to make a choice in the objects of imitation; and he observed, that these were objects of which the local colours were extremely beautiful, which nevertheless were in a great measure destroyed by the reflection of light, by the porosity of the body, and by different luminous tints, &c. He perceived also, that in every object there was an infinite number of half tints, which conducted to the knowledge of harmony. In short, he observed in the objects of nature, a particular agreement of transparency, of opacity, of rudeness, and of polish, and that all objects differed in the degrees of their tints and their shades. It was in this diversity he sought the perfection of his art; and in the execution he moderated the effect of natural colours. For example, in a carnation which had many demi-tints, he confined himself to one; and he employed even less than a demi-tint, where there were few in the natural object. By this means he obtained a colouring exquisitely fine; and in this part he was a great master, and deserves to be carefully studied."

Titian has in general little expression in his pictures, and he sometimes introduces figures which augment the coldness of the piece; for if it be true that the heads, even in historical painting, ought to be studied after nature, it is true also that an individual nature ought not to be presented, but one general and ideal. It is necessary that they should be men, while they resemble not men we are accustomed to see. The painter fails in the effect which he ought to produce, if, when he represents Achilles, Hector, and Cæsar, his personages are familiar to our observation.

The colours of his paintings are so mingled together, as to give no idea of the colours on his pallet; which distinguishes him from Rubens, who placed his colours one at the side of another. It is impossible to say, on the narrowest inspection, with what colours he produced his tints. This practice, which enabled him to imitate so exactly the colours of nature, gives a marked distinction to his manner of painting. In the examination of his works, the critics lose an ordinary source of pleasure, which arises from marking the freedom of hand; but they may console themselves with the natural and exquisite touches of this artist.

He is of historical painters one of those who have succeeded in landscape. His situations are well chosen; his trees are varied in their forms, and their foliage well conceived. He had a custom of representing some remarkable appearance in his landscapes to render them more striking.

16
Lombard school.

The distinguishing characteristics of this school are, grace,

grace, an agreeable taste for design, without great correction, a mellowness of pencil, and a beautiful mixture of colours.

Antonio Allegri, called *Corregio*, was the father and greatest ornament of this school. He began like the painters of his time to imitate nature alone; but, as he was chiefly delighted with the graceful, he was careful to purify his design from all short turnings and unnecessary angles. He perceived that largeness contributed to grace; and therefore he not only rejected all small figures, but enlarged as much as possible the outlines, avoided acute angles and straight lines, and by these means give an easy grandeur to his design. He made his figures elegant and large; he varied the outlines by frequent undulations; but he was not always pure and correct.

Corregio painted in oil, a kind of painting susceptible of the greatest delicacy and sweetness; and as his character led him to cultivate the agreeable, he gave a pleasing captivating tone to all his pictures. He sought transparent colours to represent shades conformable to nature, and adopted a manner of glazing which actually rendered his shadows more obscure. Obscurity in painting cannot be fully obtained without transparent colours; for these absorb the rays of light, and of consequence give less reflection. He laid his colours very thick on the brightest parts of his pictures, to make them capable of receiving, by a proper touch, the greatest degree of light. He perceived, that the reflections of light correspond with the colour of the body from which they are reflected; and on these principles he founded his theory of colours with respect to light and shade and reflection. But it is chiefly in the colour of his shades that he deserves to be imitated; for his lights are too clear, and somewhat heavy; and his fleshy parts are not sufficiently transparent.

Harmony and grace are connected together; and on this account Corregio excelled also in harmony. As the delicacy of his taste suffered him not to employ strong oppositions, he naturally became a great master in this part, which chiefly consists of easy gradations from one extreme to another. He was harmonious in his design, by making the lines which formed the angles of the contour arched and undulated. But in the lights and shades, he placed always between the two extremes a space which served to unite them, and to form a passage from the one to the other. The delicacy of his organs made him perceive, better than any other artist, what relief was necessary to the eye after a violent exertion; and he was therefore careful to follow a bold and prevailing colour with a demi-tint, and to conduct the eye of the spectator, by an invisible gradation, to its ordinary state of tension. In the same manner (says Mengs) does agreeable and melting music pull one so gently out of sleep, that the awaking resembles enchantment more than the disturbing of repose. A delicate taste in colours, a perfect knowledge of the claro obscuro, the art of uniting light to light, and shade to shade, together with that of detaching the objects from the ground, inimitable, grave, and perfect harmony, were the qualities which distinguished Corregio from all the painters, and placed him near the head of his profession.

The Caracci, Lewis, Augustin, and Hannibal, formed what is called the *second Lombard school*, which is frequently distinguished by the name of the *school of Bologna*.

Lewis was the master of the other two; he had studied the works of Titian and Paul Veronese at Venice, those of André del Sarte at Florence, those of Corregio at Parma, and those of Jules Romaen, at Mantua; but he chiefly endeavoured to imitate the manner of Corregio. Hannibal fluctuated between Corregio and Titian. Augustin their rival in painting had his mind cultivated by learning, and devoted part of his time to poetry and music, to dancing and to other manly exercises. These three painters often employed their talents on the same piece; and it was admirable that their united labours seemed to be animated with the same spirit.

They established an academy at Bologna, which their zeal for the advancement of their art made them call *l'Academia degli Desiderosi*; but it was afterward called the *Academy of the Caracci*, because the reputation which these artists acquired, permitted not a more illustrious name to be given to an establishment of which they were the founders. In this school were taught the art of constructing models, perspective, and anatomy; lessons were given on the beautiful proportions of nature, on the best manner of using colours, and on the principles of light and shade. They held frequent conferences, in which not only artists, but men of general knowledge, were permitted to elucidate points relative to the art of painting: but they were separated upon Hannibal's going to Rome to adorn the gallery of the cardinal Farnese.

The works of the Caracci are often, from the resemblance of their manner, confounded together; especially those which were finished previous to the residence of Hannibal at Rome. Meanwhile each of them has a decided character distinct from the other two. Lewis had less fire, but more of gracefulness and grandeur; Augustin had more spirit in his conception, and more pleasantness in his execution: Hannibal is characterized by boldness, by a design more profound, by an expression more lucky, and by an execution more solid.

Sir Joshua Reynolds, who saw the works of Lewis at Bologna, holds him out in his discourses as the best model for what is called *style* in painting; which is the faculty of disposing colours in such a manner as to express our sentiments and ideas. "Lodovico Caracci," says he, "(I mean in his best works) appears to me to approach the nearest to perfection. His unaffected breadth of light and shadow, the simplicity of colouring, which, holding its proper rank, does not draw aside the least part of the attention from the subject, and the solemn effect of that twilight which seems diffused over his pictures, appears to me to correspond with grave and dignified subjects better than the more artificial brilliancy of sunshine which enlightens the pictures of Titian."

Hannibal is esteemed by the best judges as a model for beauty and design. Those who blame him for becoming less a colourist at Rome than he was at Bologna, ought to recollect that it is his performances at Rome which have chiefly secured his reputation. Severe critics have maintained that his design is too little varied in his figures; that he excels only in male beauty; that in imitating ancient statues, he excites some resemblance,

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but without arriving at the sublimity of ideas and of style which characterize the ancients; or, in other words, that he hath successfully imitated the exterior of their manner, but that he was incapable of reaching the interior and profound reasonings which determined those admirable artists.

The success of Hannibal, and the reputation which he acquired, have been pernicious to the art. His successors, deluded by these considerations, have made him the object of their imitation, without ascending to the sources from which he derived his knowledge, and which he never could equal. The result has been, that, instead of becoming equal to Hannibal, they have often copied his imperfections.

17 The French school.

This school has been so different under different masters, that it is difficult to characterize it. Some of its artists have been formed on the Florentine and Lombard manner, others on the Roman, others on the Venetian, and a few of them have distinguished themselves by a manner which may be called their own. In speaking in general terms of this school, it appears to have no peculiar character; and it can only be distinguished by its aptitude to imitate easily any impression; and it may be added, speaking still in general terms, that it unites, in a moderate degree, the different parts of the art, without excelling in any one of them.

It is equally difficult to determine the progress of painting in France. Miniature painting, and painting on glass, were early cultivated in that country; and in these two kinds, the Italians had often recourse to the French artists. When Francis I. encouraged Rosso a Florentine, and Primatice a Bolognian, the painters in France were not remarkable for any superior talent; but they were capable of working under these foreign artists.

Cousin, a painter on glass, and portrait painter, was the first who established any kind of reputation in France. He was correct, but possessed very little elegance of design.

Painting, for some time encouraged by Francis I. fell into a state of languor, from which it was not recovered till the reign of Louis XIII. Jacques Blanchard, formed at the Venetian school, and called *the French Titian*, flourished about this period. But as he died young, and without educating any pupils to perpetuate his manner, he must be regarded as a single good artist, and not as a founder of the French school.

In the same manner Poussin, one of the greatest French painters, and who is called *the Raphael of France*, educated no pupils, nor formed any school. His style and character of painting are described by Sir Joshua Reynolds as simple, careful, pure, and correct. No works of any modern (adds the same author) have so much of the air of antique painting as those of Poussin. His best performances have a remarkable dryness of manner, which, though by no means to be recommended for imitation, yet seems perfectly correspondent to that ancient simplicity which distinguishes his style.

In the latter part of his life he changed from this manner to one much softer and richer; where there is a greater union between the figures and the ground. His favourite subjects were ancient fables; and no painter was ever better qualified to paint such objects, not only from his being eminently skilled in the knowledge of the ceremonies, customs, and habits of the ancients, but from his being so well acquainted with the different characters which those who invented them gave their allegorical figures.

If Poussin, in the imitation of the ancients, represents Apollo driving his chariot out of the sea by way of representing the sun rising, if he personifies lakes and rivers, it is no way offensive in him, but seems perfectly of a piece with the general air of the picture. On the contrary, if the figures which people his pictures had a modern air or countenance, if they appeared like our countrymen, if the draperies were like cloth or silk of our manufacture, if the landscape had the appearance of a modern view, how ridiculous would Apollo appear? instead of the sun, an old man; or a nymph with an urn, instead of a river or a lake.

Poussin, however, more admired than imitated, had no manner of influence in forming the French school. Simon Vouet, his enemy and persecutor, had this honour, because his pupils, in the happy age of the arts in France, conferred on it the highest splendour. Vouet was a man of distinguished abilities; but the school which he erected would have had no continuance if his scholars had pursued his manner of painting. He had a kind of grandeur and facility; but his design was false with regard to colours,, and without any idea of expression. It was said of him, that he only needed to take the pencil in his hand to finish with one stroke the subject which he had conceived; and on this account one is tempted to be pleased, because he is astonished. He had the merit of destroying the insipid manner which reigned in France, and of pointing the way to a better taste.

If Vouet laid the foundation of the French school, Le Brun finished the edifice. When Le Brun was placed under the tuition of Vouet, he astonished his master and the rest of his pupils with the rapidity of his progress. At the age of 26 he finished his piece called the *horses of Diomede*, which gained a place in the palace royal (A), beside those of the most eminent painters. He was afterwards recommended to Poussin; but the young artist was more disposed by his natural inclinations to that modern part of the art which is called the *great machine*, than to the profound and studied manner of the Greek artists. Poussin at the same time was of great service to him in recommending to his study the monuments, the customs, the dress of the ancients; their architecture, their rites, their spectacles, their exercises, their combats, and their triumphs.

Le Brun had a noble conception and a fruitful imagination. He was on no occasion inferior to the vast compositions which he undertook, and he chiefly excelled in rigorous costume and exact likenesses.

Few painters have united so great a number of essential

(A) Where it may now be is uncertain. Perhaps it perished during the revolutionary frenzy of the French, which at first threatened the utter destruction of every thing connected with science or the liberal arts.

tial qualities and accessories of the art; and if he had superiors, it consisted in this, that they possessed some particular quality in a more eminent degree.—He was a good drawer; but his design was far from being so elegant as that of Raphael, or so pure as that of Domenique, and it was less lively than that of Hannibal Caracci, whom he had taken for a model. In drapery he followed the Roman school: the clothes which he gave to his figures were not like those of the Venetian school, of such and such a stuff; they were draperies and nothing more, and this manner agreed with the heroic style of his works; but in this part he was not equal to the painter of Urbino.—He had studied the expression of the affections of the soul, as is evident from his treatise on the character of the passions: but after observing the general characters, and establishing the principal strokes of expression, he thought he reached the whole extent of this subject, which is so infinitely extended. He always employed the few characters which he had once found out, and neglected to study the prodigious variety of gradations by which the interior affections are manifested in the exterior appearance. He fell then into the manner of repeating always; and possessed neither the delicacy, nor the depth, nor the extreme justness of Raphael's expression. He loved and possessed in a high degree the grand machine of the art; he was delighted with great compositions: and he gave them life and animation, and variety; but he wanted the vigour and inspiration of Raphael. His compositions are formed on philosophical principles, but those of Raphael are created. Le Brun thought well; Raphael, Poussin, Le Seur, thought most profoundly.—Le Brun had elevation, but he was not elevated like Raphael, to the sublime.

In colouring, Le Brun did not imitate the painters of the Venetian school. The sweet attractions and strong and solid colours of the schools of Rome and Lombardy seem rather to have been the object of his imitation; and from them also he learned an easy, agreeable, and bold management of the pencil.

As Le Brun possessed a great share of lively imagination, he delighted in allegory, which gives the greatest scope for ingenious invention. The fecundity and resources of his imagination appeared still farther, in his inventing symbols for his allegorical figures, without resting contented with those employed by the ancients. But fanciful representations of this kind are distant from the operations of true genius Spirit and thought in the arts are very different from spirit and thought in literary productions. A painter of moderate abilities may introduce into his works a great deal of the invention which belongs to poetry without enriching his peculiar art. The true spirit of painting consists in making the figures appear in the very circumstances and attitudes in which they are supposed to act, and penetrated with the sentiments with which they ought to be affected. By these means the spectator is more certainly interested than if the actions and thoughts were represented by allegorical symbols. Poussin appears to have less waste of spirit and imagination than Le Brun, while at the same time he gives more delight to people of spirit and imagination.

Eustach le Sueur was the contemporary and rival of Le Brun; and no painter approached nearer to Raphael in the art of drapery, and in disposing the folds in the most artful and the noblest manner. His design was in general more slender than that of Raphael, but, like his, it was formed on the model of the ancients. Like Raphael he represented with art and precision the affections of the soul; like him, he varied the air of the head, according to the condition, the age, and the character of his personages; and, like him, he made the different parts of every figure contribute to the general effect. His intention in composing was to express his subject, not to make shining contrasts or beautiful groups of figures, not to astonish and bewitch the spectator by the deceitful pomp of a theatrical scene, or the splendour of the great machine. His tones are delicate, his tints harmonious, and his colours, though not so attractive as those of the schools of Venice and Flanders, are yet engaging. They steal peaceably on the soul, and fix it without distraction on the parts of the art, superior to that of colouring.

His preaching of St Paul, and the picture which he painted at St Gervais, which the critics compare with the best productions of the Roman school, and the 22 pictures which he painted for the Carthusian monastery at Paris, and which were formerly in possession of the king, are esteemed his best pieces. His contemporaries affirm, that he considered as sketches merely those excellent performances which are the glory of the French school.

If Le Sueur had lived longer, or if, like Le Brun, he had been employed under a court, fond of the arts, and of learning, to execute the great works of the age, the French school would have adopted a different and a better manner. The noble beauty of his heads, the simple majesty of his draperies, the lightness of his design, the propriety of his expression and attitudes, and the simplicity of his general disposition, would have formed the character of his school. The deceitful pomp of theatrical decoration would have been more lately introduced, or perhaps would never have appeared, and Paris might have been the counterpart to Rome. But as Le Brun, by an accidental concurrence of favourable circumstances, was the fashionable painter, to be employed or rewarded it was necessary to imitate his manner; and as his imitators possessed not his genius, his faults became not only current but more deformed.

The French school not long ago changed its principles; and if, when peace shall be restored to this unhappy nation, they continue to follow the road which, while the artists flourished among them, they marked out for themselves, they have the chance of becoming the most rigid observers of the laws imposed on the Greek artists. The count de Caylus, pupil of Bouchardion, who by his rank and fortune had the means of encouraging the imitators of the ancients, and of the masters of the 15th century, first formed the design of restoring a pure taste to the art of painting. He was seconded by the talents of M. Vien, an artist who had only occasion to have his lessons and his example laid before him.—In this manner commenced a revolution, so much the more wonderful, as it was scarcely ever known that any nation substituted a system of simple and rigid excellence in place of a false and glittering taste. The history of all nations, on the contrary, discovers a gradual progress from a rude beginning to perfection, and afterwards to irremediable decay. The French had the prospect of stopping short in this ordinary course. They began

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began in a manner which promised success; and the best consequences may be expected, from being in possession of those precious treasures of sculpture and painting of which they plundered the countries subdued by their arms.

18
The German school.

In Germany there can hardly be said to be a school, as it is a continuation of single artists, who derived their manner from different sources of originality and imitation. There were some German painters of eminence, when the art, emerging from its barbarous state, first began to be cultivated with success in Europe. As they were totally unacquainted with the ancients, and had scarcely access to the works of their contemporaries in Italy, they copied nature alone, with the exception of somewhat of that stiffness which forms the Gothic manner. It is this manner, if we speak of the early German painters, which characterizes their school. But this is by no means the case with their successors, part of whom were educated in Flanders and part in Italy: For if Mengs or Dietrich were comprehended in this school, there would be nothing peculiar to its manner discovered in their works. And it is therefore necessary to confine our observations to the more ancient German painters, in whom the Gothic style is conspicuous.

Albert Durer was the first German who corrected the bad taste of his countrymen. He excelled in engraving as well as painting. His genius was fertile, his compositions varied, his thoughts ingenious, and his colours brilliant. His works, though numerous, were finished with great exactness; but as he owed every thing to his genius, and as works of inferior merit were by the false taste of the times preferred to his, it was impossible for him altogether to avoid the faults of his predecessors. He is blamed for stiffness and aridity in his outlines, for little taste or grandeur in his expression, for ignorance of the costume of aerial perspective and of gradation of colours; but he had carefully studied lineal perspective, architecture, and fortification.

John Holbeen or Holbein, nearly contemporary with Albert Durer, painted in oil and water colours. He excelled chiefly in history and in portrait painting. His colours are fresh and brilliant, and his works are highly finished; but in his historical subjects, his draperies are not in so good a taste as those of Albert Durer.

19
The Flemish school.

The Flemish school is recommended to the lovers of the art by the discovery, or at least the first practice, of oil painting. Van Mander gives us the account of this wonderful discovery in the following words: "John Van Eyck was so excellent a chemist, that he discovered a method of varnishing his distemper colours with a varnish, which was made of some oils, and was very pleasing on account of the gloss and lustre it gave them. Many artists in Italy had vainly attempted to find out that secret; they never hit on the true method. It happened once that John, in his usual manner, having highly finished one of his pictures on boards, and having varnished it with his new invented varnish, exposed it to dry in the sun; but whether the boards were not well joined, or whether the heat of the sun was too violent, the boards split asunder and opened in the junctures. John saw with concern that his work was spoiled, and resolved to contrive something against future accidents of the same kind. Being disgusted at distemper painting and varnishing, he thought of a varnish that might dry without sunshine; and having tried many oils and substances, he found that linseed and nut oil dried better than any other. He boiled them with some other drugs, and produced the best varnish in the world. Ever bent on improvements, he found, after much inquiry, that colours mixed with these oils worked and dried extremely well, and when dried would be water-proof. He observed likewise, that these oils would animate and give them a gloss and lustre without any further varnishing." The truth, however, of this account is now very much questioned; and it is even proved by the manuscripts of Theophilus Presbyter, and also by some old paintings in England, that this method of painting was discovered long before the time of John Van Eyck. At the same time we admit, that John and his brother Hubert may have been the first who brought oil painting into general practice, not only by showing the excellence of which it was susceptible, but also by making several improvements on the art. And this is the more probable, from the great reputation which their pictures acquired over all Europe, by the softness and delicacy of their colours. The attention of the Italian painters was chiefly excited, insomuch that Antoine de Messina performed a journey into Flanders for the express purpose of acquiring the confidence of John Van Eyck, and of discovering the secret.

John de Bruges was the founder of painting as a profession in Flanders; Peter Paul Rubens was the founder of the art. This extraordinary person produced an immense number of works. He excelled equally in historical, portrait, and landscape painting; in fruits, flowers, and in animals. He both invented and executed with the greatest facility; and to show the extent of his powers, he frequently made a great number of sketches on the same subject altogether different, without allowing any time to elapse between them. The works of Rubens were destitute of that soft inspiration, productive of sweet and pleasant effects, so conspicuous in the works of Raphael; but he possessed that sprightliness of genius and strength of mind which is ever ready to burst forth in wonderful and astonishing effects. His figures appear to be the exact counterpart of his conceptions, and their creation nothing more than a simple act of the will.

His talent for design is unjustly censured, for on every occasion his design is noble and easy. He had great knowledge of anatomy, but he was hurried away by the impetuosity of his imagination and the ardour for execution; he preferred splendour to the beauty of forms, and sacrificed correctness of design too often to the magic of colours. In short, his qualities suppose a mind full of fire and vigour, rather than accuracy or profound thought. His drapery may be considered rather as fine than properly adapted to his figures; for, in the language of the art, to *clothe* and to *give drapery* are not synonymous terms. A portrait painter may excel in clothing his personages, while be is totally incapable of giving good drapery to a historical painting. His chief merit consists in colouring; though in this branch of the art he has not equalled Titian. He is the first among painters eminent for pomp and majesty; the first among those who speak to the eye, and the power of the art is often carried by him almost to enchantment.

It is evident from the works of Rubens, that his method of painting was to lay the colours in their place, one at the side of another, and mix them afterwards by a

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"Rubens (says Sir Joshua Reynolds) is a remarkable instance of the same mind being seen in all the various parts of the art. The whole is so much of a piece, that one can scarce be brought to believe but that if any one of them had been more correct and perfect, his works would not be so complete as they appear. If we should allow a greater purity and correctness of drawing, his want of simplicity in composition, colouring, and drapery, would appear more gross."

In his composition his art is too apparent. His figures have expression, and act with energy, but without simplicity or dignity. His colouring, in which he is eminently skilled, is notwithstanding too much of what we call *tinted*. Throughout the whole of his works there is a proportional want of that nicety of distinction and elegance of mind, which is required in the higher walks of painting; and to this want it may be in some degree ascribed, that those qualities which make the excellency of this subordinate style appear in him with their greatest lustre.—Indeed the facility with which he invented, the richness of his composition, the luxuriant harmony and brilliancy of his colouring, so dazzle the eye, that, whilst his works continue before us, we cannot help thinking that all his deficiencies are fully supplied.

The Flemish school, of which Rubens is the greatest master, is remarkable for great brilliancy of colours and the magic of the *claro-obscuro*. To these may be joined a profound design, which is yet not founded on the most beautiful forms; a composition possessed of grandeur, a certain air of nobleness in the figures, strong and natural expressions; in short, a kind of national beauty, which is neither copied from the ancients nor from the Roman nor Lombard schools, but which deserves to please, and is capable of pleasing.

20 The Dutch school.

To speak in general terms, and without regarding a great number of exceptions, the Dutch school carries none of the above qualities to great perfection, except that of colouring. Far from excelling in the beauty of heads and forms, they seem chiefly to delight in the exact imitation of the lowest and most ignoble. Their subjects are derived from the tavern, the smith's shop, and from the vulgar amusements of the rudest peasants. The expressions are sufficiently marked; but it is the expression of passions which debase instead of ennobling human nature. One would think that they practised the art of degrading the bodies and souls of men.

It must be acknowledged, at the same time, that the Dutch painters have succeeded in several branches of the art. If they have chosen low objects of imitation, they have represented them with great exactness; and truth must always please. If they have not succeeded in the most difficult parts of the claro-obsuro, they at least excel in the most striking, such as in light confined in a narrow space, night illuminated by the moon or by torches, and the light of a smith's forge. The Dutch understand the gradations of colours, and by their knowledge of contrast they have arrived at the art of painting light itself. They have no rivals in landscape painting, considered as the faithful representation or picture of a particular scene; but they are far from equalling Titian, Poussin, Claude Lorrain, &c. who have carried to the greatest perfection the ideal landscape, and whose pictures, instead of being the topographical representation of certain places, are the combined result of every thing beautiful in their imagination or in nature. The Dutch, however, distinguish themselves by their perspective, by their clouds, sea scenes, animals, fruits, flowers, and insects; and they excel in miniature painting. In short, every thing which requires a faithful imitation, colour, and a nice pencil, is well executed by the Dutch painters.

Holland has also produced history painters, as Octavius Van Been, and Vander Hilst the rival of Vandyke, and perhaps his superior: but it is not in the works of those artists that we find the character of the Dutch school.

Neither is the origin of their style to be derivéd from the works of Lucas of Leyden, though, from the time he flourished, viz. about the end of the 15th century, he may be considered as the patriarch of the Dutch school. Lucas painted in oil, in water colours, and on glass; and the kinds of his painting were history, landscape, and portrait. His picture of the Last Judgment is preserved in the Hotel-de-Ville of Leyden; it possesses vast merit in point of composition, and a great variety of figures.

If miniature painting be considered as a characterisic of the Dutch school, Cornelius Polembourg may be regarded as the father of it. He possessed the colour, delicacy of touch, and disposition of the claro-obscuro, which chiefly distinguish this school; and if any thing is to be added, it is want of correctness in his design.

But if the choice of low figures is its chief characteristic, this is to be found in the greatest perfection in the works of the celebrated Rembrandt Vanryn; and it is the more offensive in this artist, as his compositions frequently required an opposite choice of figures. As his father was a miller near Leyden, his education must altogether have depended on the exertion of great talents and the study of nature. He studied the grotesque figure of a Dutch peasant or the servant of an inn with as much application as the greatest masters of Italy would have studied the Apollo of Belvidere or the Venus de Medicis. This was not the manner of elevating himself to the noble conceptions of Raphael; but it was acquiring the imitation of truth in vulgar painting.

"Rembrandt (says M. Descamps) may be compared to the great artists for colour and delicacy of touch and claro-obscuro. It appears that he would have discovered the art, though he had been the first person that ever attempted it. He formed to himself rules and a method of colouring, together with the mixture of colours and the effect of the different tones. He delighted in the great oppositions of light and shade; and he seems to have been chiefly attentive to this branch of the art. His workshop was occasionally made dark, and he received the light by a hole, which fell as he chose to direct it on

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on the place which he desired to be enlightened. On particular occasions he passed behind his model a piece of cloth of the same colour with the ground he wanted; and this piece of cloth receiving the same ray which enlightened the head, marked the difference in a sensible manner, and allowed the painter the power of augmenting it according to his principles.

"Rembrandt's manner of painting is a kind of magic. No artist knew better the effects of different colours mingled together, nor could better distinguish those which did not agree from those which did. He placed every tone in its place with so much exactness and harmony, that he needed not to mix them, and so destroy what may be called the flower and freshness of the colours. He made the first draught of his pictures with great precision, and with a mixture of colours altogether particular: he proceeded on his first sketch with a vigorous application, and sometimes loaded his lights with so great a quantity of colour, that he seemed to model rather than to paint. One of his heads is said to have a nose nearly as much projected as the natural nose which he copied."

Such is the power of genius, that Rembrandt, with all his faults, and they are enormous, is placed among the greatest artists by M. Descamps, who saw his works, and was himself an artist. It is necessary to observe, that if Rembrandt was ignorant of the essential parts of his art, or neglected them, he was yet acquainted with expression, which alone was capable of giving animation to his works. His expressions are not noble, but they are just, lively, and excited with great judgment.

John de Laer, a miniature painter, and who made choice of his subjects from common life, deserves a distinguished place in the Dutch school. He painted hunting-scenes, the attacks of robbers, public festivals, landscapes, and sea-views; and he ornamented his pictures with old ruins, and enriched them with figures of men and animals. He had a correct design, and employed vigorous and lively colouring.

Van Ostade, although born at Lubeck, Gerard Dow, Metzu, Miris, Wovermans, Berghem, and the celebrated painter of flowers Van Huysum, belong to the Dutch school.

The greater part of the schools of which we have treated have no longer any existence. Italy alone had four schools, and there only remain at present a very few Italian artists known to foreigners. The school of Rubens is in vain sought for in Flanders. If the Dutch school still exists, it is not known beyond the precincts of Holland. Mengs a German artist has made himself famous in our days; but it was in Italy that he chiefly improved his talents and exercised his art. M. Dietrich, another German, has made himself known to strangers; but two solitary artists do not form a school.

21 The English school.

A new school is formed in our times and in our own country, called the *English school*. It is connected with the academy in London, instituted in 1766 by letters patent from the king, and formed only in 1769. Sir Joshua Reynolds is the undoubted founder of it. His works give him a distinguished rank among the artists of the present age, and exhibit a genius in their author which has seldom been surpassed: but the effects which he has contrived to give to them by the formation of a new school, and by the good principles which his discourses to academicans, and his example as a painter, have disseminated, will secure his reputation as long as England shall esteem the advantages and the worth of great abilities. The English taste appears to be formed on the great masters of the Italian and the Flemish schools. Sir Joshua was a great admirer of Michael Angelo, and particularly recommends him to the attention of the academicans. "I feel (says Sir Joshua), a self-congratulation in knowing myself capable of such sensations as he intended to excite. I reflect, not without vanity, that these discourses bear testimony of my admiration of that truly divine man; and I should desire that the last words which I should pronounce in this academy, and from this place, might be the name of—*Michael Angelo*." But though he thus enthusiastically admired this very great man, yet he allows, what cannot indeed be denied, that he was capricious in his inventions: "And this (says he) may make some circumspection necessary in studying his works; for though they appear to become him, an imitation of them is always dangerous, and will prove sometimes ridiculous. 'In that dread circle none durst tread but he.' To me, I confess his caprice does not lower the estimation of his genius, even though it is sometimes, I acknowledge, carried to the extreme; and however those eccentric excursions are considered, we must at the same time recollect, that those faults, if they are faults, are such as never could occur to a mean and vulgar mind; that they flowed from the same source which produced his greatest beauties; and were therefore such as none but himself was capable of committing; they were the powerful impulses of a mind unused to subjection of any kind, and too high to be controuled by cold criticism."

The effect of Sir Joshua's discourses is visible in the pictures of this school. The Death of General Wolfe, the Departure of Regulus for Carthage, the Arrival of Agrippina, and some other subjects, are decided proofs that the English school is acquainted with greatness of style, boldness of expression, and the art of managing a great number of figures. It will be fortunate for the painters of this school, if, more rigid with regard to their forms, than ambitious of poignant and astonishing effects, they support the character which they have already acquired. But although England had not enjoyed this brilliant success in painting, she would have immortalized herself by the excellency of her engravings.

It is easy to perceive in all those schools the cause of the character which distinguishes them. In the Roman school, it is the excellent education of its first masters, together with the precious remains of antiquity found in the ruins of ancient Rome. In the Venetian school, the magnificence derived from the commerce of the east, the frequency of feasts and masquerades, and the necessity of painting to the rich and luxurious, who were accustomed to behold these magnificent objects, were the causes of its gaudy taste. In the Dutch school, the peculiarity of its grovelling manner may be accounted for from the habits of the artists. Accustomed to visit taverns and workshops, and having most commonly exposed to their view low

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low and grotesque figures, they represent in their pictures the objects which were most familiar to them in life.

* Encyclop. Beaux Arts, tom. i.

"Beauty (says a French writer *) ought to be the characteristic of the English school, because the artists have it often exposed to their view. If this beauty is not precisely similar to that among the ancients, it is not inferior to it. The English school should also distinguish itself for truth of expression; because the liberty enjoyed in that country gives to every passion its natural and unbiassed operation. It will probably long preserve its simplicity unpolluted by the pomp of theatrical taste and the conceit of false graces, because the English manners will long preserve their simplicity.

"Examine the picture of a Frenchwoman (continues he) painted by an artist of that nation, and you will generally find, in place of expression, a forced grin, in which the eyes and the forehead do not partake, and which indicates no affection of the soul. Examine the picture of an Englishwoman done by one of their painters, and you observe an elegant and simple expression, which makes you at once acquainted with the character of the person represented."

Sect. III. *Comparison between the Ancient and Modern Painting.*

No person of judgment or taste hesitates to give the superiority to the ancient sculpture; but the Moderns comfort themselves with refusing the same superiority to the Greek artists in the art of painting. The small number of their productions which remain, and the probable conjectures which may be formed concerning those which have perished, go the length to prove that the Greek painters conducted themselves on other principles than those which have received the sanction of custom and the force of laws in our schools. But this censure might be applied with equal justice to Homer as an epic poet, and to Sophocles and Euripides as writers of tragedy.

The principal difference between the ancient and modern manner of painting consists in the complication of figures, and the pompous decoration of scenery which prevails in the modern, when compared with the unity and simplicity of the ancient painters. This simplicity, however, does not seem to arise from the want of capacity, but from a choice, as Polygnotus, one of their most ancient painters, represents in one of his pieces the siege of Troy, and in another the descent of Ulysses into hell; but they soon decided in favour of simplicity, and their pieces generally contain one or two figures, and very rarely more than three or four.

Poetry in this particular is conducted on very different principles. A poet may with great propriety multiply his characters, and enter into details of a variety of actions, because the whole of his characters and actions do not occupy the mind of his readers at the same time. The whole of his arts consists in making one naturally succeed another; but every part of the poem which contains a separate transaction would make a picture capable of fixing the attention. In painting, the eye takes in the whole; and it is by no means satisfied if 20 or 30 figures are presented to it, which it cannot possibly comprehend. It is in vain to group the figures, or to call the attention to the principal object by a greater degree of light; the spectator is anxious to examine every object which is presented to him; and if they are not to be examined, for what reason are they painted? An excellent piece, at the same time, consisting of a great number of figures, will give pleasure; but it is accompanied with that fatigue which one experiences when he runs over a gallery furnished with a great variety of excellent pictures.

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Those observations on the attention of the spectator led the Greeks to make similar ones on the attention of the artists. They perhaps thought that the painter who had to execute a great variety of figures in the same work, could not study each of them with equal accuracy and care; and of consequence that he might produce something astonishing in the extent, and yet disgusting in the detail.

This difference, however, between ancient and modern painting, cannot give any decided principle to determine on their comparative merit. We are accustomed to behold assemblages in nature! and it is a fact, that even in affecting scenes a great number of figures may not only be brought together, but that they may heighten the distress. It is supposing a picture to have little effect, to imagine that we can coolly, and with the same kind of attention, examine the principal and the accessory figures. If it is highly finished, our whole soul must be absorbed in that object which the artist intended to be most conspicuous; and if we give any attention to the surrounding figures, we shall consider them as spectators of the same scene, and derive from them an addition of sympathy and of feeling. The whole question in this particular point of view amounts to this, that the moderns have chosen a more difficult part; and if they have executed it with success, their merit is greater. And this observation will hold good, unless it can be proved that it is utterly impossible to make an assemblage of figures lead to one general and common effect.

The proper manner of deciding the comparative merit of the ancients and moderns, is to consider, as far as we have sufficient data to go upon, to what degree the ancients excelled in the particular departments of this art. There are two sources from which we can derive information; namely, from the morsels of antiquity which yet remain, and from what the ancient writers have said on the subject of painting, both of which are extremely defective. It is allowed, however, by every skilful person who has viewed the remains of ancient paintings, that none of them appear to be the performances of superior artists, notwithstanding much merit in the design and accuracy in the drawing, which indeed seems to have been habitual to almost every ancient artist. The best among these paintings (according to Sir Joshua Reynolds), "the supposed marriage in the Aldobrandine palace," is evidently far short of that degree of excellence undoubtedly implied in the descriptions of ancient authors, and which from them we are fairly led to expect.

Still more defective, if possible, is this last species of evidence: for we have no direct treatise remaining on the subject by any of the ancients, although many were composed by their artists. The passages from which we are

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are to decide are, either the cursory remarks of writers not expressly treating on the subject of painting, or the descriptions of those who at best can rank but as *amateurs* of a fashionable art. From these indeed we may pretty safely assert the degree of excellence which the passages imply; but we should reason very inconclusively, were we to deny them any higher or any other merit than appears to be strictly contained in these scattered observations. Let any one for a moment place the modern painters in his mind in the same situation as the ancients, and he will quickly decide on the truth of those remarks.

Nevertheless, it is necessary on this subject to derive some conclusions from the information which is occasionally given in ancient authors. That the ancients paid a particular attention to design, would be evident from the manner in which they speak of this department of the graphic art, even though the moderns were not in possession of such remaining proofs of their excellence herein (though by artists of an inferior class), as to place this point beyond the reach of doubt.

Indeed, when it is considered that, with respect to freedom and correctness of outline, painting and sculpture are very nearly connected; that Phidias and Apelles were nearly contemporaries; that many of the ancient painters, such as Zeuxis, Protogenes, Apelles, &c. were accustomed to modelling for the purpose of sculpture or of casting; that the extreme elegance of design in the ancient statues is so notorious as to be the acknowledged model even for modern artists; and that these ornaments of sculpture were well known and universally admired among the ancients—we shall have little hesitation in admitting their equality with the moderns so far as design is concerned. But should any doubt remain on this point, the drawings from the antiquities of Herculaneum will be striking proofs that truth, elegance, and spirit, in a degree rarely to be met with among the moderns, were habitual even to the common run of artists in the declining age of ancient painting.

The ancients excelled moreover not merely in the common and obvious parts of design; but they appear to have had no inconsiderable degree of skill in the art of *foreshortening*. The performance of Pausanias is a proof of this: *Fecit autem grandes tabulas sicut spectatam in Pompeii porticibus boum immolationem. Eam enim picturam primus invenit, quam postea imitati sunt multi, equavit nemo. Ante omnia, cum longitudinem bovis ostendere vellet, adversum eum pinxit, non transversum, et abunde intelligitur amplitudo. Dein cum omnes qui volunt eminentia videri, candicantia faciant, coloremque condant, hic totum bovem atri coloris fecit; umbræque corpus ex ipso dedit; magna prorsus arte in æquo extantia ostendens et in confracto solida omnia.*

Nor will it be difficult to show, that the ancient painters were not inferior to the moderns in *expression*. The state of sculpture alone among the ancients would almost furnish a decisive proof that the sister art of painting could not be deficient. Among the ancient statues which yet remain, expression is carried to a wonderful height; not merely the features of the face, but almost every muscle of the body, combining to enforce the idea intended to be conveyed.

Mr Webb* very properly observes, that "the ancients thought characters and manners so essential to painting, that they expressly term *painting* an art descriptive of manners. Aristotle in his *Poetics* says of Polygnotus, that he was a painter of the manners; and objects to Zeuxis, his weakness in this part." We have in Philostratus the following description of a picture: "We may instantly (says he) distinguish Ulysses by his severity and vigilance; Menelaus by his mildness; and Agamemnon by a kind of divine majesty. In the son of Tydeus is expressed an air of freedom; Ajax is known by his sullen fierceness; and Antilochus by his alertness. To give to these such sentiments and actions as are consequential from their peculiar characters, is the ethic of painting."

* *On Painting and Poetry*, p. 142.

Another instance of excellence in expression among the ancient paintings was the Medea of Timomachus. She was painted about to kill her infant. Ausonius speaks with admiration of the mingled expression of anger and maternal fondness in her face and manner.

Immanem exhausit rerum in diversa laborem
Fingeret affectum matris ut ambiguum,
Ira sub est lachrymis, miseratio non caret ira,
Altere utrum videas ut sit in altere utro.

It may not be amiss, however, at this period of our inquiry, to make some observations on the testimonies of ancient authors respecting this subject.

It is certainly true, that when the works of an ancient artist are praised for any real or supposed merit, the commendations will be relative to the degree of perfection to which the art had arisen at the time, and to the opportunities of information, the taste, and judgement of the person who bestows them. Excellence will always be ascribed to him who leaves his cotemporaries far behind; and those performances will often be considered as supremely beautiful which exceed in beauty all that have gone before.

In like manner, a person of natural sensibility, but who has been accustomed all his life to performances of an inferior stamp, will be in raptures at any which much exceed the best he has heretofore been taught to admire; and whatever opportunities of information he may have, his evidence will not be of much weight, if he do not possess a sufficient degree of taste and judgment to use them properly.

In ascertaining therefore the degree of credit due to the praises bestowed on any performance in a branch of the fine arts, we must take into consideration the general state of the art at the time, and the competence of the person who bestows the praise.

No slight degree of probability, however, may be attained on both those points, by attending to a circumstance not generally noticed, viz. that in an advanced state of the art, and when the observer is acquainted with his subject, the praise will seldom be given in loose, general, and comprehensive expressions; but the terms in which it is conveyed will be characteristic and determinate, and often technical; they will frequently show the state of the art, by marking the subdivisions and the skill of the observer by judicious discrimination. When, added to these, the latter can resort for comparison to any existent standard of perfection, his praise may fairly be adopted in its full extent, and regarded as evidence upon the point in question.

To apply these observations to painting, it is clear, with

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with respect to the most difficult, the most fundamental, and the highest in rank among the departments of the art, viz. design and expression, that the ancients were fully equally to the moderns; and their expressions of praise must be allowed to imply an equal degree of absolute skill, with similar expressions, if applied to the great masters of modern art. It is also clear that painting was extremely cultivated among the ancients, and that their good painters were more esteemed than artists of equal merit in modern times; that what we should term gentlemen artists were frequent with them (*apud Romanos quoque honos maturè huic arti contigit*); and that the expressions of the ancient connoisseurs evince much theoretical and technical knowledge of the art, and display a distribution of its parts almost as minute, complete, and scientific, as the present state of it can boast.

With regard to colouring, the praises of the ancient authors chiefly relate to the style of it as exerted upon single figures or particular tints. It may therefore be doubted whether the ancients were possessed of the art of distributing their colours through the whole of a picture, so as to produce an harmony and general tone of colouring similar to that which we admire in the Lombard and Flemish schools. The present remains of ancient paintings do not appear to warrant any such conclusion; but being undoubtedly the works of inferior hands, their authority is very small when alleged against the general or particular merit of the ancient artists. The following extracts will be sufficient to evince, that the ancients did attend to this technical branch of colouring.

Indeed the modern technical expressions appear borrowed, from the following passage of Pliny, which may be regarded as decisive on the subject. *Tandem sese ars ipsa distinxit, et invenit* lumen atque umbras, *differentia colorum alterna vice sese excitante. Dein adjectus est splendor; alius hic quam lumen; quem quia inter hoc et umbram esset appellaverunt tonon. Commissuras vero colorum et transitus*, harmogen. The *lumen atque umbras* of this passage might have been regarded as merely descriptive of the light and shade necessary to relieve single figures, if it were not for the subsequent definition of *tone*. The *harmogen* of Pliny means the *handling* or skilful blending and softening colours into one another, rather than what we now call *harmony*.

Lucian †, in his fine description of that spirited painting by Zeuxis of the male and female centaurs, after relating the treatment of the subject itself, proceeds to notice the technical execution of the picture; and he praises particularly the truth and delicacy of the drawing, the perfect blending of the colours, the skilful shading, the scientific preservation of size and magnitude, and the equality and harmony of the proportions throughout the whole piece.

† In his *Zeuxis*.

Painters, says Plutarch, increase the effect of the light and splendid parts of a picture by the neighbourhood of dark tints and shades. And Maximus Tyrius observes, that bright and vivid colours are always pleasant to the eye; but this pleasure is always lessened if you omit to accompany them with somewhat dark and gloomy. These passages seem to imply a knowledge of the use of cold and dark tints even where a brilliancy of tone is required. The best among the ancient painters, however, seem to have preferred a chaste and sober style of colouring to the gaudiness and flutter of the later artists.

Upon the whole, therefore, with respect to colouring as employed upon single figures, as the ancients were fully as competent to judge of excellence herein as the moderns; as the expressions of the ancient connoisseurs are very warm in praise of the colouring of many of their painters; as they appear also to have attended very much to the art of colouring; and moreover, as probable evidence can be adduced that they attended to miniature painting—a considerable degree of merit may be allowed them in the use of the colours they possessed.

Chiaro scuro, or the art of placing and proportioning light and shade in such a manner as to produce a pleasing effect, independently of any other circumstance connected with the picture, has been commonly deemed a characteristic difference between the knowledge of ancient and modern painters. On this subject the works of the ancients now remaining give little or no information; hence Sir Joshua Reynolds observes, "that this, which makes so considerable a part of the modern art, was to them totally unknown. If the great painters had possessed this excellence, some portion of it would have infallibly been diffused, and have been discovered, in the works of the inferior ranks of artists which have come down to us, and which may be considered as on the same rank with the paintings that ornament our public gardens." But the accounts of the places where these paintings have been found, make it evident that they were thus ornamented at a very considerable expence. The generality of them consist of single figures; some of them of two or three figures, generally relieved by an uniform ground; and, except in a few instances, evidently designed as mere reliefs to a compartment, and answering, as near as may be, to the stuccoed ornaments in our modern rooms; nor do any of them seem the works of artists equal in their day to those at present employed on the painted ceilings of private houses.

The Abbé du Bos maintains, on the other hand, that what Pliny and other ancient writers say concerning the claro-obscuro and the delightful distribution of light and shade, is altogether decisive; and that their writings are full of so many probable circumstances, that it cannot be denied that the ancients at least equalled the most celebrated of the moderns in this part of the art.

On the examination of the greater part of the passages from antiquity, it is evident that they may relate to the light and shade of single figures, without involving what is now called the science of the claro-obscuro. The passage of Pliny, however, already quoted, and several others, go very near to prove that this branch of painting was understood among the ancients. The dark, the light, and mezzotint, are evidently and accurately described in that passage.

Equally strong is that expression in Quintilian: *Zeuxis luminum umbrarumque rationem invenisse traditur*. This cannot well be otherwise translated than by the *science* of light and shade.

That some technical knowledge of the effect producible by *masses* of light and shade was possessed by the ancients, appears indubitable from the passages adduced:

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to what extent it was carried cannot now be ascertained. In all probability they were much inferior in this respect to the moderns; otherwise, although much science of this kind could hardly be expected from the trifling performances that remain, much more would have occurred on the subject, it would have been more largely dwelt on, and more precisely expressed among the observations of ancient authors on the best painting of the ancient masters.

Neither is there sufficient evidence that the ancients were eminent in that important branch of the composition of a picture, which consists in distributing the figures and objects in groups, or masses. There are few examples of this difficult branch of the art among the remaining antiquities; and indeed from the paucity of the figures introduced in the generality of these ancient paintings, there is little room to expect them. But what makes it still more doubtful whether the ancients attained any degree of eminence in grouping is, that among the many paintings of these great masters enumerated by Pliny, Lucian, or Philostratus, there is none of them praised for this species of excellence. This, however, it must be confessed, may as well arise from want of knowledge in the writer as of skill in the artist; for in a picture found in Herculaneum, which represents in all probability the education of Achilles, the figure of an old man holding a child on his knees, together with that of a woman behind him, form a very agreeable group. A work of the same collection, painted in one colour on marble, consists of five figures grouped very much after the modern idea, if it were not that three of the heads are at the same height. It is extremely probable, that this morsel had been the copy of a picture finished in the purest times of the art. But although it were proved that the ancients did not attempt grouping their figures, it is still uncertain whether this might not arise from their peculiar and perhaps excellent taste in the arts. Wishing to enjoy in the fullest manner their painted figures as they enjoyed the aspect of a statue, they took care that every figure should be detached from another in the same picture, which permitted them to give their objects more relief, and to render them more distinct to the eye of a distant spectator.

We are not therefore to conclude, that they were entirely ignorant of grouping, on the one hand; or that they declined the execution of it from want of skill, on the other. Indeed it actually appears to have been technically attended to by them, whatever might be their comparative excellence in it; for Apelles is expressly asserted by Pliny to have been inferior to Melanthius in composition (*de dispositione*): and one of their paintings mentioned by the same author, is said to have contained one hundred figures; but this unwieldy number must have been offensive, if they were not grouped with some skill.

From the connection between the sister arts of poetry, painting, and sculpture, and the admirable performance of the ancients in the other two departments of the fine arts, it is reasonable to conclude that the ancient painters were not deficient in invention. Many instances, were it necessary, might be collected in support of their well-founded claim to this branch of the art; but it will be sufficient to observe, that as invention is rather a natural endowment than an acquired talent, and as the ancients universally seem to be at least equal to the moderns in the gifts of genius and good sense, we cannot but admit, on their part, an equality with ourselves so far as invention is concerned.

Very nearly connected with the subject of invention is that of the *costume*; by which is meant an attention to probability with respect to times, places, objects, persons, and circumstances in the transaction represented.

The ancient paintings now remaining, so far from exhibiting any proofs of attention to this important branch of the art, are full of gross violations of probability, and representations of impossible connection. But very little stress is to be laid on these instances; first, because they are evidently the performances of artists of no reputation; secondly, because none of them to which this objection can be made are regular representations of any person or transaction; and thirdly, because, as they were (for the most part) manifestly intended as ornaments to apartments, the taste of the owner, and not of the artist, would of course be chiefly consulted. Nothing, however, can be more clear than that the ancients required an attention to probability in the works of their artists; and from the manner in which their writers express themselves on the subject (not so much recommending the practice of it as taking it for granted), we may reasonably conclude, that their best painters were seldom guilty of any gross violation of the costume. *Sint ficta simillima veris* was an apophthegm generally known, and when known must have been universally admitted.

The principles of the costume are well expressed and illustrated by Horace in the first lines of his Art of Poetry; and Vitruvius, lib. vii. chap. 5. says, that no pictures can be approved of which have not a resemblance to truth and nature. Whether the ancient painters put in practice a greater share of good sense with respect to the costume than the moderns, cannot now be accurately determined; the advantage seems to be in favour of the former; for, as we shall have occasion more particularly to observe afterwards, the most celebrated of modern painters from Raphael to Sir Joshua Reynolds have been guilty of such flagrant breaches of probability, as would appear astonishing to those who are not in the habit of expecting them.

It has been doubted whether the ancients were acquainted with the science of *perspective*: and if the remains of ancient painting were alone to decide the question, it must be determined against them: for the works of the ancient painters now in possession of the moderns afford no proof of attention to the rules of perspective equal to the performance of a modern sign-painter. The picture of the sacrifice among the Herculanean antiquities, and the fourth of the prints which Bellori has published and described, taken from the paintings in the sepulchre of the Nasonii, are barely tolerable; but the other landscapes (almost the only remaining antique paintings which admit of perspective) are grossly defective in this particular; so much so indeed, that considering the late period when landscape-painting was introduced among the ancients, together with this manifest imperfection in point of perspective of such as are yet extant, we cannot help suspecting the inferiority of the ancients in this respect. In perspective, as in the chiaro-scuro, had good practice been common, some traces would have been discovered in the works of their lowest artists.

And yet some general knowledge of the principles, and some degree of attention to the practice, of perspective, cannot well be denied to the ancients. They were good mathematicians, they were excellent architects, and some of them are celebrated for their skill in scene-painting. Geminus the Rhodian, contemporary with Cicero, was the author of an express treatise on perspective; and Euclid, Heliodorus, Larisseus, Agatharcus, wrote also on the same subject. It is well known, besides, that the ancients practised the art of painting in perspective on walls in the same way that it is now done by the moderns; Pliny (Nat. Hist. lib. xxxv. c. 4.) says, that one of the walls of the theatre of Claudius Pulcher, representing a roof covered with tiles, was finished in so masterly a manner, that the rooks, birds of no small sagacity, taking it for a real roof, attempted to light upon it. We are likewise told, that a dog was deceived to such a degree, by certain steps in a perspective of Dantos, that expecting to find a free passage, he made up to them in full speed, and dashed out his brains. But what is still more, Vitruvius tells us in express terms by whom and at what time this art was invented. It was first practised by Agatharcus, a contemporary of Æschylus, in the theatre of Athens; and afterwards reduced to certain principles, and treated as a science, by Anaxagoras and Democritus; thus faring like other arts which existed in practice before they appeared in theory.

Portrait painting seems to have been a principal employment of the first artist whom the ancients have to boast of, since Alexander is said to have permitted no painter but Apelles, and no sculptor but Phidias, to take his likeness. Pliny particularizes several instances of Apelles as a portrait painter.

In the drawing and colouring of single figures, to which the ancients paid particular attention, they must be allowed to be equal, if not superior, to the moderns. That spirit and animation, ease and dignity, were *common* to the performances of ancient artists, the ancient statues and paintings still remaining most evidently evince; and as they possessed, therefore, all the requisites to excel in portrait painting, a branch of the art at all times much in request among them, there is good reason to infer, in favour of the ancients, at least an equality with the moderns in this respect.

On the whole, all the principal parts of the art, as purity of design, and beauty and expression in the forms, were not only to be found in the ancient statues, but were actually the foundation of excellence in modern painting; and hence we may conclude that their painters formed on the same models, and very often the same men who excelled in sculpture, were not inferior in those branches of the art. But with regard to the inferior parts, the allurement of colouring, the ingenuity of the claro-obscuro, the splendour of composition, the art of grouping figures, and the nice *handling* of the pencil, the moderns are superior to those ancient painters who have most deserved the notice of their contemporary writers. It is still to be observed, however, that the progress of the arts among the ancients, from the principal parts to the more splendid, was somewhat similar to that among the moderns; and as the painters of the first rank were more immediately the objects of criticism and delight to authors of genius, it is impossible at this distance of time to state any accurate comparison between the ancients and moderns in what may be termed the decay of the art. This is particularly the case with regard to colours, there being in ancient as well as in modern times two epochs; the one comprehending Polygnotus and his immediate successors, and the other the painters both of Greece and Rome after the art began to decay. The colouring of Polygnotus was hard, and his manner had something of wildness; but his design was in the highest style of perfection. In the succeeding ages the colouring was more varied, more brilliant, more harmonious, and the handling more agreeable; but the design was less elegant and exact. And the true connoisseurs continued to prefer the works of the ancient school, in the same manner that the best writers in our times prefer the works of the Roman and Venetian masters to the more brilliant pictures of their successors. From this statement of facts it is abundantly evident, that from the ancient authors we can form some comparison between the best ancient and modern painters in those things which are most excellent in the art; while in the inferior parts, from the silence of authors, and the loss of paintings, we have no grounds upon which a comparison can be accurately made. See Arts Fine, Supplement.

Part I. Principles of the Art, and the Order of the Artist's Studies.

WE have joined these together, because they are like cause and effect; and comprehend both on what parts in the execution of the art the painter is to employ his chief attention, and also the manner in which he is to employ it. We shall not therefore be confined to the dry and abstract, and as it were unembodied principles, but connect them with the useful and agreeable branches of the art, in that order in which it appears to us they should be studied.

Sect. I. *Of Anatomy.*

To ask if the study of anatomy is requisite to a painter, is the same thing as to ask if, in order to learn any science, a man must first make himself acquainted with the principles of it. It would be an useless waste of time to cite, in confirmation of this truth, the authorities of the ancient masters, and the most celebrated schools. A man, who is unacquainted with the form and construction of the several bones which support and govern the human frame, and does not know in what manner the muscles moving these bones are fixed to them, can make nothing of what appears of them through the integuments with which they are covered; and which appearance is, however, the noblest object of the pencil. It is impossible for a painter to copy faithfully what he sees, unless he thoroughly understand it. Let him employ ever so much time and study in the attempt, it

Anatomy. it cannot but be attended with many and great mistakes: just as it must happen to a man, who undertakes to copy something in a language which he does not understand; or to translate into his own, what he has written in another, upon a subject with which he is not acquainted.

It seldom happens, that nothing more is required of a painter than to copy exactly an object which he has before him. In still and very languid attitudes, in which every member is to appear motionless and dead, a living model may, no doubt, yield for a long time a faithful image, and prove an useful pattern to him. But in regard to gestures any way sudden, motions any way violent, or those momentary attitudes which it is more frequently the painter's business to express, the case is quite different. In these a living model can hold but an instant or two; it soon grows languid, and settles into a fixed attitude, which is produced by an instantaneous concourse of the animal spirits. If, therefore, a painter possess not so thoroughly all the principles of anatomy, as to be at all times able to have immediate recourse to them; if he know not the various manners in which the several parts of the human body play, according to their various positions; living models, far from proving an useful pattern to him, will rather tend to lead him astray, and make him lose sight of truth and nature, by exhibiting the very reverse of what is required, or at least exhibiting it in a very faint and imperfect manner. In living models, we often behold those parts slow, which should be quick; those cold and torpid, which should have the greatest share of life and spirit in them.

Nor is it, as some may be apt to imagine, merely to represent athletic and vigorous bodies, in which the parts are most bold and determined, that anatomy is requisite: it should be understood to represent persons of the most delicate frame and condition, even women and children, whose members are smoothest and roundest, though the parts made known by it are not to be strongly expressed in such object; just as logic is equally requisite under the polished insinuations of the orator, and the rough arguments of the philosopher.

But it is needless to spend much time in proving, that a painter should be acquainted with anatomy; or in showing, how far his acquaintance with it should extend. For instance, it is unnecessary for him to enter into the different systems of the nerves, blood-vessels, bowels, and the like; parts which are removed from the sight, and which therefore may be left to the surgeon and the physician, as being a guide in the operations of the former and in the prescriptions of the latter. It is enough for the painter, to be acquainted with the skeleton; in other words, with the figure and connection of the bones, which are, in a manner, the pillars and props of a human body; the origin, progress, and shape of the muscles which cover these bones; as also the different degrees in which nature has clothed the muscles with fat, for this substance lies thicker upon them in some places than in others. Above all, he should know in what manner the muscles effect the various motions and gestures of the body. A muscle is composed of two tendinous and slender parts, one called the *head*, the other the *tail*, both terminating at the bones; and of an intermediate part, called the *belly*. The action of a muscle consists in an extraordinary swelling of this intermediate part, while the head remains at rest, so as to bring the tail nearer the head, and consequently the part to which the tail of the muscle is fixed, nearer to that part into which the head is inserted. Anatomy.

There are many motions to effect which several of the muscles (for this reason called *co-operating muscles*) must swell and operate together, while those calculated to effect a contrary motion (and therefore called *antagonist muscles*) appear soft and flaccid. Thus, for example, the biceps and the brachiæus internus labour when the arm is to be bent, and become more prominent than usual; while the gemellus, the brachiæus externus, and the anconæus, whose office is to extend the arm, continue, as it were, flat and idle. The same happens respectively in all the other motions of the body. When the antagonist muscles of any part operate at one and the same time, such part becomes rigid and motionless. This action of the muscle is called *tonic*.

Michael Angelo intended to give the public a complete treatise upon this subject; and it is no small misfortune, that he never accomplished so useful a design. This great man, having observed, as we are told in his life by Condivi, that Albert Durer was deficient on the subject, as treating only of the various measures and forms of bodies, without saying a word of their attitudes and gestures, though things of much greater importance, resolved to compose a theory, founded upon his long practice, for the service of future painters and statuaries. And, certainly, no one could be better qualified to give anatomical precepts for that purpose, than he who, in competition with Da Vinci, designed that famous cartoon of naked bodies, which was studied by Raphael himself, and afterwards obtained the approbation of the Vatican, the greatest school of the art we are now treating of.

The want of Michael Angelo's precepts may, in some measure, be supplied by other books written on the same subject by Moro, Cesio, and Tortebat; and lately by Bouchardon, one of the most famous statuaries in France. But nothing can be of equal service to a young painter, with the lessons of some able dissector; under whom, in a few months, he may make himself master of every branch of anatomy which he need to be acquainted with. A course of osteology is of no great length; and of the infinite number of muscles discovered by curious myologists, there are not above 80 or 90, with which nature sensibly operates all those motions which he can ever have occasion to imitate or express. These, indeed, he should closely study, these he should carefully store up in his memory, so as never to be at the least loss for their proper figure, situation, office, and motion.

But there is another thing, besides the dissection of dead bodies, by which a young painter may profit greatly; and that is anatomical casts. Of these we have numbers by several authors; nay, some which pass under the name of *Buonarroti* himself. But there is one in which, above all the rest, the parts are most distinctly and lively expressed. This is the performance of Hercules Lelli, who has perhaps gone greater lengths in this kind of study than any other master. We have, besides, by the same able hand, some casts of particular parts of the human body, so curiously coloured for the use of young painters, as to represent these parts exactly as they appear on removing the integuments; and thus, by

Anatomy.

by the difference in their colour as well as configuration, render the tendinous and the fleshy parts, the belly and the extremities of every muscle, surprisingly distinct; at the same time that, by the various direction of the fibres, the motion and play of these muscles become very obvious; a work of the greatest use, and never enough to be commended! Perhaps, indeed, it would be an improvement, to give the muscles various tints; those muscles especially which the pupil might be apt to be mistake for others. For example, though the mastoideus, the deltoides, the sartorius, the fascia lata, the gasterocnemii, are, of themselves, sufficiently distinguishable, it is not so with regard to the muscles of the arm and of the back, the right muscles of the belly, and some others, which, either on account of the many parts into which they branch, or of their being interwoven one with another, do not so clearly and fairly present themselves to the eye. But let the cause of confusion to young beginners be what it will, it may be effectually removed, by giving, as already hinted, different colours to the different muscles, and illumining anatomical figures; in the same manner that maps are coloured, in order to enable us readily to distinguish the several provinces of every kingdom, and the several dominions of every prince.

The better to uuderstand the general effect, and remember the number, situation, and play of the muscles, it will be proper to compare, now and then, the anatomical casts, and even the dead body itself, with the living body covered with its fat and skin; and above all things with the Greek statues still in being. It was the peculiar happiness of the Greeks, to be able to characterize and express the several parts of the human body much better than we can pretend to do; and this, on account of their particular application to the study of naked figures, especially the fine living ones which they had continually before their eyes. It is well known, that the muscles most used are likewise the most protuberant and conspicuous; such as, in those who dance much, the muscles of the legs; and in boatmen, the muscles of the back and arms. But the bodies of the Grecian youth, by means of their constant exertion of them in all the gymnastic sports, were so thoroughly exercised, as to supply the statuary with much more perfect models than ours can pretend to be.

There are a great many exercises, which a young painter should go through while engaged in the study of anatomy, in order to make himself more thoroughly master of that science. For example: The thighs of any figure, a Laocoon for instance, being given, he should add to them legs suitable to that state in which the muscles of the thighs are represented, that is the muscles which serve to bend and extend the legs, and to effectuate in them such a precise position and no other. To the simple contour of an anatome or a statue, he should add the parts included by it, and give it a system of muscles conformable to the quality of that particular contour; for every contour denotes some one certain attitude, motion, exertion, and no other. Exercises of this kind would soon establish him in the most fundamental principles of painting, especially if he had an opportunity of comparing his drawings with the statue or cast from which the parts given him to work upon were taken, and thereby discovering and correcting his mistakes. This method is very like that used by those who teach the Latin tongue; when, having given their scholars a passage of Livy or Cæsar already translated into their mother-tongue, to translate back into Latin, they make them compare their work with the original text.

Perspective.

Sect. II. *Of Perspective.*

The study of perspective should go hand in hand with that of anatomy, as not less fundamental and necessary. In fact, the contour of an object drawn upon paper or canvas, represents nothing more than such an intersection of the visual rays sent from the extremities of it to the eye, as would arise on a glass put in the place of the paper or canvas. Now, the situation of an object at the other side of a glass being given, the delineation of it on the glass itself depends entirely on the situation of the eye on this side of the glass; that is to say, on the rules of perspective: a science which, contrary to the opinion of most people, extends much farther than the painting of scenes, floors, and what generally goes under the name of *quadratura*. Perspective, according to that great master da Vinci, is to be considered as the reins and rudder of painting. It teaches in what proportion the parts fly from, and lessen upon the eye; how figures are to be marshalled upon a plain surface, and foreshortened. It contains, in short, the whole rationale of design.

Such are the terms which the masters best grounded in their profession have employed to define and commend perspective: so far were they from calling it a *fallacious art*, and an *insidious guide*; as some amongst the moderns have not blushed to do, insisting that it is to be followed no longer than it keeps the high road, or leads by easy and pleasant paths. But these writers plainly show, that they are equally ignorant of the nature of perspective, which, founded as it is on geometrical principles, can never lead its votaries astray; and of the nature of their art, which, without the assistance of perspective, cannot, in rigour, expect to make any progress, nay, not so much as to delineate a simple contour.

When a painter has formed a scene in his mind, and supposed, as it is customary, that the capital figures of this scene lie close, or almost close, to the back of his canvas, he is, in the next place, to fix upon some point on this side of the canvas, from which he would choose his piece should be seen. But in choosing this point, which is called the *point of sight*, regard should be had to its situation to the right or left of the middle of the canvas: but, above all things, to its distance and its height with respect to the lower edge of the canvas; which edge is called the *base line*, and is parallel with the horizontal line that passes through the eye. For by assuming the point of sight, and consequently the horizontal line, too low, the planes upon which the figures stand will appear a great deal too shallow; as, by assuming it too high, they will appear too steep, so as to render the piece far less light and airy than it ought to be. In like manner, if the point of sight is taken at too great a distance from the canvas, the figures will not admit of degradation enough to be seen with sufficient distinctness; and if taken too near it, the degradation

Perspective. dation will be too quick and precipitate to have an agreeable effect. Thus, then, it appears, that no small attention is requisite in the choice of this point.

When a picture is to be placed on high, the point of sight should be assumed low, and *vice versa;* in order that the horizontal line of the picture may be, as near as possible, in the same horizontal plane with that of the spectator; for this disposition has an amazing effect. When a picture is to be placed very high, as, amongst many others, that of the Purification, by Paolo Veronese, engraved by le Fevre, it will be proper to assume the point of sight so low, that it may lie quite under the picture, no part of whose ground is, in that case, to be visible; for, were the point of sight to be taken above the picture, the horizontal ground of it would appear sloping to the eye, and both figures and buildings as ready to tumble head foremost. It is true, indeed, that there is seldom any necessity for such extraordinary exactness; and that, unless in some particular cases, the point of sight had better be rather high than low: the reason of which is, that, as we are more accustomed to behold people on the same plane with ourselves, than either higher or lower, the figures of a piece must strike us most when standing on a plane nearly level with that upon which we ourselves stand. To this it may be added, that by placing the eye low, and greatly shortening the plane, the heels of the back figures will seem to bear against the heads of the foremost, so as to render the distance between them far less perceptible than otherwise it would be.

The point of sight being fixed upon according to the situation in which the picture is to be placed, the point of distance is next to be determined. In doing this, a painter should carefully attend to three things: first, that the spectator may be able to take in, at one glance, the whole and every part of the composition; secondly, that he may see it distinctly; and, thirdly, that the degradation of the figures, and other objects of the picture be sufficiently sensible. It would take up too much time to lay down certain and precise rules for doing all this, considering the great variety in the sizes and shapes of pictures; for which reason we must leave a great deal to the discretion of the painter.

But there is a point still remaining, which will not admit of the least latitude. This is, the delineation of the picture, when once the point of sight has been fixed upon. The figures of a picture are to be considered as so many columns erected on different spots of the same plane; and the painter must not think of designing any thing, till he has laid down, in perspective, all those columns, which are to enter his composition, with the most scrupulous exactness. By proceeding, in this manner, he may not only be sure of not committing any mistake in the diminution of his figures according to their different distances, but may flatter himself with the thoughts of treading in the steps of the greatest masters. It is to the punctual observance of these laws, that we are to attribute the grand effect of some paintings by Carpazio and Mantegna, so careless in other respects; whereas a single fault against them is often sufficient entirely to spoil the works of a Guido, in spite of the sublimity and beauty of his superior style,

Now, as the demonstration of the rules of perspective depends on the doctrine of proportions, on the properties of similar triangles, and on the intersection of planes, it will be proper to put an abridgement of Euclid into the hands of the young painter, that he may understand these rules fundamentally, and not stand confined to a blind practice of them: but, then, there is nothing in this author relative to the art of painting, which may not be easily acquired in a few months. For, as it would be of no use to a painter to launch out into the anatomical depths of a Monro or an Albinus, it would be equally superfluous to perplex himself with the intricacies of the higher geometry with a Taylor, who has handled perspective with that rich profoundness, which we cannot help thinking does a great deal more honour to a mathematician, than it can possibly bring advantage to a simple artist.

But though a much longer time were requisite to become a perfect master of perspective, a painter, surely, ought not to grudge it; as no time can be too long to acquire that knowledge, without which he cannot possibly expect to succeed. Nay, we may boldly affirm, that the shortest road in every art is that which leads through theory to practice. From theory arises that great facility, by means of which a man advances the quicker, in proportion as he is surer of not taking a wrong step; whilst those, who are not grounded in the science, labour on in perpetual doubt; obliged, as a certain author expresses it, to feel out their way with a pencil, just as the blind, with their sticks, feel for the streets and turnings, with which they are not acquainted.

As practice, therefore, ought in every thing to be built upon principle, the study of optics, as far as it is requisite to determine the degree in which objects are to be illuminated or shaded, should proceed hand in hand with that of perspective: And this, in order that the shades, cast by figures upon the planes on which they stand, may fall properly, and be neither too strong nor too light; in a word, that those most beautiful effects of the chiaro-scuro may run no risk of ever receiving the lie from truth, which sooner or later discovers itself to every eye.

Sect. III. *Of Symmetry.*

Symmetry. The study of symmetry, it is obvious, should immediately follow that of anatomy; for it would avail us little to be acquainted with the different parts of the human body, and their several offices, were we at the same time ignorant of the order and proportion of those parts in regard to the whole in general, and to each other in particular. The Greek statuaries distinguished themselves above all others, as much by the just symmetry of their members, as by their skill in anatomy; but Polycletes surpassed them all by a statue, called the *Rule*, from which, as from a most accurate pattern, other artists might take measures for every part of the human body. These measures, to say nothing of the books which treat professedly of them, may now be derived from the Apollo of Belvedere, the Laocoon, the Venus of Medicis, the Faunus, and particularly the Antinous; which last was the rule of the learned Poussin.

Plinii Nat Hist. lib xxxiv. c. 8.

It is the general opinion of painters, that the ancients were not so happy in representing the bodies of children, as they are allowed to have been in representing those of women and men; especially those of their gods; in which they excelled to such a degree, that with these gods were often worshipped the artists who had carved them. Yet the

Symmetry.

the Venus of Gnidus by Praxiteles was not more famous than her Cupid, on whose account alone people flocked to Thespiæ*. To children, say they, the ancients knew not how to impart that softness and effeminacy which Flammingo has since contrived to give them, by representing their cheeks, hands, and feet, swelled, their heads large, and with scarce any belly. But such critics seem to forget, that these first sketches of nature very seldom come in the painter's way, and that this puny and delicate state has not in its form even the least glimmering of perfection. The ancients never undertook to represent children less than four or five years old; at which age the superfluous humours of the body being in some measure digested, their members begin to assume such a contour and proportion as may serve to point out what they are afterwards likely to be. This observation is confirmed by the children which we meet with in ancient basso-relievos and paintings: for they are all doing one thing or another; like those most beautiful little Cupids in a picture at Venice, who are playing with the arms of Mars, and lifting up the ponderous sword of that deity; or that little urchin in the Danäe of Caracci, who empties a quiver of its arrows in order to fill it with the golden shower. Now, what can be a greater blunder in point of costume, than to attribute actions, which require some degree of strength and judgment, to infancy, to that raw and tender age so totally unable to govern and support itself?

* *Cic. in Verrem, de signis. Strabo*, lib. ix. *Plin. Nat. Hist* lib. xxxvi. c. 5.

Let a young painter consider the Greek statues ever so often, of whatever character or age they may be represented, it is impossible he should ever consider them without discovering new beauties in them. It is therefore impossible he could copy them too often, according to that judicious motto placed by Maratti on his print called *The school*. This truth was acknowledged by Rubens himself; for though, like one bred, as he was, in the foggy climate of the Low Countries, he generally painted from the life; in some of his works he copied the ancients; nay, he wrote a treatise on the excellency of the ancient statues, and on the duty of a painter to study and imitate them. As to the satirical print, or rather pasquinade, of the great Titian, in which he has represented a parcel of young monkeys aping the group of Laocoon and his sons; he intended nothing more by it than to lash the dulness and poverty of those artists, who cannot so much as draw a figure without having a statue before them as a model.

In fact, reason requires, that an artist should be so much master of his art, as seldom to stand in need of a pattern. To what other purpose is he to sweat and toil from his infancy, and spend so many days and nights in studying and copying the best models; especially the finest faces of antiquity, which we are still possessed of; such as the two Niobes, mother and daughter; the Ariadne, the Alexander, the young Nero, the Silenus, the Nile: and likewise the finest figures; for instance, the Apollo, the Gladiator, the Venus, and others; all which (as was said of Pietro Festa), he should have, as it were, perfectly by heart! With a stock of excellencies like these, treasured up in his memory, he may one day hope to produce something of his own without a model; form a right judgment of those natural beauties which fall in his way; and, when occasion offers, avail himself properly of them.

It is very injudicious to send boys to an academy to draw after naked figures, before they have imbibed a proper relish for beautiful proportions, and have been well-grounded in the true principles of symmetry. They should first learn, by studying the precious remains of antiquity, to improve upon life; and discern where a natural figure is faulty through stiffness in the members, or clumsiness in the trunk, or in any other respect; so as to be able to correct the faulty part, and reduce it to its proper bounds. Painting, in this branch, is, like medicine, the art of taking away and adding.

It must not, however, be dissembled, that the methods hitherto laid down are attended with some danger: for by too slavish an attention to statues, the young painter may contract a hard and dry manner; and by studying anatomies too servilely, a habit of representing living bodies as stripped of their skin: for after all, there is nothing but what is natural, that, besides a certain peculiar grace and liveliness, possesses that simplicity, ease, and softness, which is not to be expected in the works of art, or even in those of nature when deprived of life. Poussin himself has now and then given into one of these extremes, and Michael Angelo very often into the other: but from this we can only infer, that even the greatest men are not infallible. It is, in short, to be considered as one instance, among a thousand, of the ill use those are wont to make of the best things, who do not know how to temper and qualify them properly with their contraries.

But no such danger can arise to a young painter from confining himself for a long time to mere design, so as not to attempt colouring till he has made himself master of that branch. If, according to a great master †, colours in painting are in regard to the eye what numbers in poetry are in regard to the ear, so many charms to allure and captivate that sense; may we not affirm, that design is in the same art what propriety of language is in writing, and a just utterance of sounds in music? Whatever some people may think, a picture designed according to the rules of perspective and the principles of anatomy, will ever be held in higher esteem by good judges, than a picture ill designed, let it be ever so well coloured. Hannibal Carraci set so great a value upon the art of contour, that, according to some expressions of his which have reached us, he considered almost every thing else as nothing in comparison with it. And this his judgment may be justified, by considering, that nature, though she forms men of various colours and camplexions, never operates in the motions contrary to the mechanical principles of anatomy, nor, in exhibiting these motions to the eye, against the geometrical laws of perspective: a plain proof, that, in point of design, no mistake is to be deemed trifling. Hence we are enabled to feel all the weight of those words in which Michael Angelo, after he considered a picture drawn by a prince of the Venetian school, addressed Vasari: "What a pity it is," said he, "that this man did not set out by studying design!" As the energy of nature shines most in the smallest subjects, so the energy of art shines most in imitating them.

† Poussin, in his *Life* by Bellori.

SECT. IV. *Of Imitation.*

WHEN you consider art as the imitation of nature (says Mengs), it is not to be understood that nature, which is the object, is more perfect than art which imitates

Imitation.

imitates it. Nature, it is confessed, offers some views of which the imitation must for ever remain imperfect, as in the instance of the claro-obscuro; but, on the other hand, in every thing relative to beauty of form, imitation may even surpass nature. Nature, in her productions, is subject to many accidents. Art, labouring on passive and obedient materials, renders perfect the objects of its creation, chooses every thing in nature the most excellent, and collects the different parts and the different beauties of many individuals into one whole. It is seldom that we find in the same man greatness of soul and the due proportions of body, vigour, suppleness, firmness, and agility, joined together. Art constantly represents what is rarely or never to be met with in human nature; regularity in the outlines, grandeur in the forms, grace in the attitudes, beauty in the members, force in the breast, agility in the limbs, address in the arms, frankness in the forehead, spirit in the eyes, and affability over the whole countenance. Let an artist give force and expression to all the parts of his subject, let him vary this force and expression as different circumstances make it necessary, and he will soon perceive that art may surpass nature. But although this be granted, the artist is not to imagine that art is *actually* arrived at this supreme degree of perfection, and can proceed no farther. The moderns seem never to have perceived the track pointed out by the ancient Greeks: for, since the revival of painting, the true and the agreeable, instead of the beautified, have been the objects of cultivation. Still, however, imitation is the first part of the art of painting, though not the most excellent or beautiful. It is a necessary step in the progress which leads forward to greater perfection.

A painter ought attentively to consider, compare together, and weigh in the balance of reason and truth, all the different styles of the great masters; but he ought likewise carefully to guard against too great a fondness for any one of them in particular that he may think proper to adopt; otherwise, to use the expression of a first-rate-master *, instead of the child, he would become the grandchild of nature.

* *Da Vinci on Painting.*

Besides, his imitation must be of generals, and not of particulars. Whatever a young painter's natural disposition may be, whether to paint boldly and freely like Tintoret and Rubens, or to labour his works, like Titian or da Vinci, let him follow it. This kind of imitation is very commendable. It is thus that Dante, at the same time that he carefully avoided adopting the particular expressions of Virgil, endeavoured to seize his bold and free manner, and at last caught from him that elegance of style which has done him so much honour.

As to the rest, nothing should hinder an able master from making use now and then of any antique, or even modern figure, which he may find his account in employing. Sanzio, in a *St. Paul at Lystra*, scrupled not to avail himself of an ancient sacrifice in basso-relievo; nor did Buonarroti himself disdain to use, in his paintings of the Sextine chapel, a figure taken from the famous cornelian which tradition tells us he wore on his finger, and which was lately in the possession of the most Christian king. Men like these avail themselves of the productions of others in such a manner as to make us apply to them, what La Bruyere said of Despreaux, that one would imagine the thoughts of other men had been of his own creation.

In general, a painter should have his eye constantly fixed on nature, that inexhaustible and varied source of every kind of beauty; and should study to imitate her in her most singular effects. As beauty, scattered over the whole universe, shines brighter in some objects than in others, he should never be without his little book and crayon, in order to make drawings of every beautiful or uncommon object that may happen to present itself; and take sketches of every fine building, every situation, every effect of light, every flight of clouds, every flow of drapery, every attitude, every expression of the passions, that may happen to strike him. He may afterwards employ these things as occasions offer; and in the mean time will have the advantage of acquiring a grand taste.

It is by carefully studying the best masters, and imitating nature, that a painter arrives at the style of perfection which the Italians call *gusto grando*, the French *le beau ideal*, and the English *the great style*.

"A mind (says Sir Joshua Reynolds), enriched by an assemblage of all the treasures of ancient and modern art, will be more elevated and fruitful in resources in proportion to the number of ideas which have been carefully collected and thoroughly digested.

"The addition of other men's judgment is so far from weakening, as is the opinion of many, our own, that it will fashion and consolidate those ideas of excellence which lay in their birth feeble, ill-shaped, and confused; but which are finished and put in order by the authority and practice of those, whose works may be said to have been consecrated by having stood the test of ages.

"When we speak of the habitual imitation and continued study of masters, it is not to be understood that I advise any endeavour to copy the exact peculiar colour and complexion of another man's mind; the success of such an attempt must always be like his who imitates exactly the air, manner, and gestures, of him whom he admires. His model may be excellent, but he himself will be ridiculous; and this ridicule arises not from his having imitated, but from his not having chosen the right mode of imitation.

"It is a necessary warrantable pride to disdain to walk servilely behind any individual, however elevated his rank. The true and liberal ground of imitation is an open field, where, though he who precedes has had the advantage of starting before you, yet it is enough to pursue his course: you need not tread in his footsteps; and you certainly have a right to outstrip him if you can.

"Nor, whilst I recommend studying the art from artists, can I be supposed to mean that nature is to be neglected: I take this study in aid, and not in exclusion of the other. Nature is, and must be, the fountain, which alone is inexhaustible; and from which all excellencies must originally flow.

"The great use of studying our predecessors is to open the mind, to shorten our labour, and to give us the result of the selection made by those great minds of what is grand or beautiful in nature: her rich stores are all spread out before us; but it is an art, and no easy art, to know how or what to choose, and how to attain and secure the object of our choice.

"Thus the highest beauty of form must be taken from nature; but it is an art of long deduction and great experience to know how to find it. I cannot avoid

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avoid mentioning here an error which students are apt to fall into.

" He that is forming himself must look with great caution and wariness on those peculiarities or prominent parts which at first force themselves on view, and are the marks, or what is commonly called the manner, by which that individual artist is distinguished.

" Peculiar marks I hold to be generally, if not always, defects, however difficult it may be wholly to escape them.

" Peculiarities in the works of art are like those in the human figure; it is by them that we are cognizable and distinguished one from another; but they are always so many blemishes, which, however, both in the one case and in the other, cease to appear deformities to those who have them continually before their eyes. In the works of art, even the most enlightened mind, when warmed by beauties of the highest kind, will by degrees find a repugnance within him to acknowledge any defects; nay, his enthusiasm will carry him so far as to transform them into beauties and objects of imitation.

" It must be acknowledged, that a peculiarity of style, either from its novelty, or by seeming to proceed from a peculiar turn of mind, often escapes blame; on the contrary, it is sometimes striking and pleasing; but it is vain labour to endeavour to imitate it, because novelty and peculiarity being its only merit, when it ceases to be new, it ceases to have value.

" A manner, therefore, being a defect, and every painter, however excellent, having a manner, it seems to follow that all kinds of faults as well as beauties may be learned under the sanction of the greatest authority."

Sect. V. *Of Colouring.*

Colouring, though a subject greatly inferior to many others which the painter must study, is yet of sufficient importance to employ a considerable share of his attention; and to excel in it, he must be well acquainted with that part of optics which has the nature of light and colours for its object. Light, however simple and uncompounded it may appear, is nevertheless made up, as it were, of several distinct substances; and the number, and even dose of these ingredients, has been happily discovered by the moderns. Every undivided ray, let it be ever so fine, is a little bundle of red, orange, yellow, green, azure, indigo, and violet rays, which, while combined, are not to be distinguished one from another, and form that kind of light called *white;* so that white is not a colour *per se,* as the learned Da Vinci † (so far, it seems, the precursor of Newton) expressly affirms, but an assemblage of colours. Now these colours, which compose light, although immutable in themselves, and endued with various qualities, are continually, however, separating from each other in their reflection from and passage through other substances, and thus become manifest to the eye. Grass, for example, reflects only green rays, or rather reflects green rays in greater number than it does those of any other colour; one kind of wine transmits red rays, and another yellowish rays: and from this kind of separation arises that variety of colours with which nature has diversified her various productions. Man, too, has contrived to separate the rays of light by making a portion of the sun's beams pass through a glass prism; for after passing through it, they appear divided into seven pure and primitive colours, placed in succession one by the other, like so many colours on a painter's pallet.

† *Trattato della Pittura,* c. 14.

Now, though Titian, Corregio, and Vandyke, have been excellent colourists, without knowing any thing of these physical subtleties, that is no reason why others should neglect them. For it cannot but be of great service to a painter to be well acquainted with the nature of what he is to imitate, and of those colours with which he is to give life and perfection to his designs; not to speak of the pleasure there is in being able to account truly and solidly for the various effects and appearances of light. From a due tempering, for example, and degrading, of the tints in a picture; from making colours partake of each other, according to the reflection of light from one object to another; there arises, in some measure, that sublime harmony which may be considered as the true music of the eye. And this harmony has its foundation in the genuine principles of optics. Now this could not happen in the system of those philosophers, who held, that colours did not originally exist in light, but were, on the contrary, nothing else than so many modifications which it underwent on being reflected from other substances, or in passing through them; thus subject to alterations without end, and every moment liable to perish. Were that the case, bodies could no more receive any hues one from another, nor this body partake of the colour of that, than scarlet, for example, because it has the power of changing into red all the rays of the sun or sky which immediately fall upon it, has the power of changing into red all the other rays reflected to it from a blue or any other colour in its neighbourhood. Whereas, allowing that colours are in their own nature immutable one into another, and that every body reflects, more or less, every sort of coloured rays, though those rays in the greatest number which are of the colour it exhibits, there must necessarily arise, in colours placed near one another, certain particular hues or temperaments of colour: nay, this influence of one colour upon another may be so far traced, that three or four bodies of different colours, and likewise the intenseness of the light falling upon each, being assigned, we may easily determine in what situations and how much they would tinge each other. We may thus, too, by the same principle of optics, account for several other things practised by painters; insomuch that a person, who has carefully observed natural effects with an eye directed by solid learning, shall be able to form general rules, where another can only distinguish particular cases.

But after all, the pictures of the best colourists are, it is universally allowed, the books in which a young painter must chiefly look for the rules of colouring; that is, of that branch of painting which contributes so much to express the beauty of objects, and is so requisite to represent them as what they really are. Giorgio and Titian seem to have discovered circumstances in nature which others have entirely overlooked; and the last in particular has been happy enough to express them with a pencil as delicate as his eye was quick and piercing. In his works we behold that sweetness of colouring which is produced by union, that beauty which is consistent with truth; and all the insensible

transmutations,

Colouring. transmutations, all the soft transitions, in a word, all the pleasing modulations, of tints and colours. When a young paintor has, by close application, acquired from Titian, whom he can never sufficiently dwell upon, that art which, of all painters, he has best contrived to hide, he would do well to turn to Bassano and Paolo, on account of the beauty, boldness, and elegance of their touches. That richness, softness, and freshness of colouring for which the Lombard school is so justly cried up, may likewise be of great service to him. Nor will he reap less benefit by studying the principles and practice of the Flemish school; which, chiefly by means of her varnishes, has contrived to give a most enchanting lustre and transparency to her colours.

But whatever pictures a young painter may choose to study the art of colouring upon, he must take great care that they be well preserved. There are very few pieces which have not suffered more or less by the length, not to say the injuries, of time; and perhaps that precious patina, which years alone can impart to paintings, is in some measure akin to that other kind which ages alone impart to medals; inasmuch as, by giving testimony to their antiquity, it renders them proportionably beautiful in the superstitious eyes of the learned. It must indeed be allowed, that if, on the one hand, this patina bestows, as it really does, an extraordinary degree of harmony upon the colours of a picture, and destroys, or at least greatly lessens, their original rawness, it, on the other hand, equally impairs the freshness and life of them. A piece seen many years after it has been painted, appears much as it would do, immediately after painting, behind a dull glass. It is no idle opinion, that Paolo Veronese, attentive above all things, to the beauty of his colours, and what is called *strepito*, left entirely to time the care of harmonizing them perfectly, and (as we may say) mellowing them. But most of the old masters took that task upon themselves; and never exposed their works to the eyes of the public, until they had ripened and finished them with their own hands. And who can say whether the *Christ* of Moneta, or the *Nativity* of Bassano, have been more improved or injured (if we may so speak) by the touchings and retouchings of time, in the course of more than two centuries? It is indeed impossible to be determined. But the studious pupil may make himself ample amends for any injuries which his originals may have received from the hands of time, by turning to truth, and to Nature which never grows old, but constantly retains its primitive flower of youth, and was itself the model of the models before him. As soon, therefore, as a young painter has laid a proper foundation for good colouring, by studying the best masters, he should turn all his thoughts to truth and nature. And it would perhaps be well worth while to have, in the academies of painting, models for colouring as well as designing; that as from the one the pupils learn to give their due proportion to the several members and muscles, they may learn from the other to make their carnations rich and warm, and faithfully copy the different local hues which appear quite distinct in the different parts of a fine body. To illustrate still farther the use of such a model, let us suppose it placed in different lights: now in that of the sun, now in that of the sky, and now again in that of a lamp or candle; one time placed in the shade, and another in a reflected light. Hence the pupil may learn all the different effects of the complexion in different circumstances, whether the livid, the lucid, or transparent; and, above all, that variety of tints and half tints, occasioned in the colour of the skin by the epidermis having the bones immediately under it in some places, and in others a greater or less number of blood-vessels or quantity of fat. An artist who had long studied such a model would run no risk of degrading the beauties of nature by any particularity of style, or of giving into that preposterous fulness and floridness of colour which is at present so much the taste. He would not feed his figures with roses, as an ancient painter of Greece shrewdly expressed it, but with good beef; a difference which the learned eye of a modern writer could perceive between the colouring of Barocci and that of Titian. To practise in that manner, is, according to a great master, no better than inuring one's self to the commission of blunders. What statues are in design, nature is in colouring; the fountain-head of that perfection to which every artist, ambitious to excel, should constantly aspire: and accordingly the Flemish painters, in consequence of their aiming solely to copy nature, are in colouring as excellent as they are wont to be awkward in designing. The best model for the tone of colours and the degradation of shades is furnished by means of the *camera obscura*. See DIOPTRICS, Sect. vi. and ix.

Drapery.

Webb, Ibid. 5.

SECT. VI. *Of Drapery.*

DRAPERY is one of the most important branches of the whole art, and accordingly demands the greatest attention and study. It seldom happens that a painter has nothing but naked figures to represent; nay, his subjects generally consist of figures clothed from head to foot. Now the flowing of the folds in every garment depends chiefly upon the relief of the parts that lie under it. A certain author, we forget his name, observes, that as the inequalities of a surface are discoverable by the inequalities in the water that runs over it, so the posture and shape of the members must be discernible by the folds of the garment that covers them. Those idle windings and gatherings, with which some painters have affected to cover their figures, make the clothes made up of them look as if the body had fled from under them, and left nothing in its place but a heap of empty bubbles, fit emblems of the brain that conceived them. As from the trunk of a tree there issue here and there boughs of various forms, so from one mistress fold there always flow many lesser ones: and as it is on the quality of the tree that the elegance, compactness, or openness of its branches chiefly depends; it is, in like manner, by the quality of the stuff of which a garment is made, that the number, order, and size of its folds must be determined. To sum up all in two words, the drapery ought to be natural and easy, so as to show what stuff it is, and what parts it covers. It ought, as a certain author expresses it, to cover the body, as it were merely to show it.

It was formerly the custom with some of our masters to draw all their figures naked, and then drape them; from the same principle that they first drew the skeletons of their figures, and afterwards covered them with muscles.

Drapery. muscles. And it was by proceeding in this manner that they attained to such a degree of truth in expressing the folds of their drapery, and the joints and direction of the principal members that lay under it, so as to exhibit in a most striking manner the attitude of the person to whom they belonged. That the ancient sculptors clothed their statues with equal truth and grace, appears from many of them that are still in being; particularly a Flora lately dug up in Rome, whose drapery is executed with so much judgment, and in so grand and rich a style, that it may vie with the finest of their naked statues, even with the Venus of Medicis. The statues of the ancients had so much beauty when naked, that they retained a great deal when clothed. But here it must be considered, that it was usual with them to suppose their originals clothed with wet garments, and of an extreme fineness and delicacy, that, by lying close to the parts, and in a manner clinging to them, they might the better show what these parts were. For this reason a painter is not to confine himself to the study of the ancient statues, lest he should contract a dry style, and even fall into the same faults with some great masters who, accustomed to drape with such light stuffs as sit close to the body, have afterwards made the coarsest lie in the same manner, so as plainly to exhibit the muscles underneath them. It is therefore proper to study nature herself, and those modern masters who have come nearest to her in this branch; such as Paolo Veronese, Andrea del Sarto, Rubens, and above all, Guido Reni. The flow of their drapery is soft and gentle; and the gatherings and plaits are so contrived, as not only not to hide the body, but to add grace and dignity to it. Their gold, silk, and woollen stuffs, are so distinguishable one from another, by the quality of their several lustres, and the peculiar light and shade belonging to each, but above all by the form and flow of their folds, that the age and sex of their figures are hardly more discoverable by their faces. Albert Durer is another great master in this branch, insomuch that Guido himself was not ashamed to study him. There are still extant several drawings made with the pen by this great man, in which he has copied whole figures from Albert, and scrupulously retained the flow of his drapery as far as his own peculiar style, less harsh and sharp, but more easy and graceful, would allow. It may be said that he made the same use of Albert that our modern writers ought to make of the best authors of the 13th century.

To drape a figure well, it is necessary that the folds be large and few in number; because large folds produce great masses of light and shadow, while small ones multiply the objects of view and distract the attention. But if the character of the drapery or kind of stuff require small folds, they should at least be distributed in groups, in such a manner that a great number of small folds shall be subordinate to an equal mass formed by a principal fold.

It is also proper to observe, that the colour of the drapery contributes to the harmony of the whole, and produces effects which the claro obscuro cannot do alone. At the same time, the principles of the claro obscuro shall preside over, or at least regulate, the art of drapery. If the folds of the stuff which cover the members exposed to the light are too strongly shaded, they will appear to enter into the members, and cut them.

Drapery contributes to the life, to the character, to the expression of the figures, provided all the movements of the folds announce the lively or more tranquil movement of those figures. The colour, and the kind of stuff, concur also to promote the general expression; brilliant or fine drapery cannot be properly introduced in a mournful subject, nor the opposite in a gay one.

The drapery must also agree with the age and character of the figures: And if nature in any instance is found to contradict those principles, it is because they relate to the ideal of the art; and it is this ideal which carries it to the greatest perfection.

Great attention is also necessary to the situation in which the figures are placed, and the actions about which they are employed. If they are in the act of ascending, a column of air weighs down the drapery; if, on the contrary, they are descending, the drapery is supported and spread out. The folds placed on every member, and the general play of the drapery, should indicate whether the figure is in action or about to be so; whether action be beginning or ending; and whether it be slow, or quick, or violent. All this is agreeable to nature; but it also partakes of the ideal, since nature never can be copied in such fluctuating situations. The practice of the Roman schools, first to draw after nature, and then to paint after the drawing, cannot be adopted by colourists; because nature, according to the kind of the stuffs, produces tones and lights which give more perfection and truth to the work. Meanwhile Raphael, who followed this practice, enjoys the first reputation for giving play to his drapery, and disposing the folds in the best order. In this part he has even attained the height of ideal beauty. He is the greatest painter of drapery, as the Venetians are the greatest in painting stuffs.

Raphael, says Mengs, imitated at first his master Perugin's manner of drapery; and he brought this manner to perfection, by studying the works of Masaccio and of Bartholomew: but he departed entirely from the taste of the school in which he was educated when he had seen the works of the ancients. It was the basso-relievo of antiquity which pointed out to him the true flowing of drapery, and he was not backward to introduce it. He discovered, by attending to the principles of the ancients, that the naked is the principal part; that drapery is to be regarded altogether as an accessory, and that it is intended to cover not to conceal; that it is employed from necessity, not caprice; that of consequence the clothes should not be so narrow as to constrain the members, nor so ample as to embarrass them; but that the artist should adapt them to the size and attitude of the figures intended to wear them.

He understood that the great folds should be placed at the large places of the body; and where the nature of the drapery required small folds, that it was necessary to give them a projection, which indicates a subordination to the principal parts.

He made his ample draperies without useless folds, and with bendings at the articulations. It was the form of the naked figure which pointed out to him the form of

Landscape and Architecture.

of his folds, and on the great muscles he formed great masses. When any part required to be foreshortened, he covered it with the same number of folds as if it had been straight; but then he crowded them in proportion to the foreshortening.

He frequently discovered the border of his drapery, to show that his figures were not dressed in a simple sack. The form of the principal parts, and the specific weight of the air, were always the causes of his folds. It was easy to discover in his works, by the folds of his drapery, the attitude of the figure previous to the one in which it was placed; and whether, for example, the arm was extended or otherwise, immediately before the action. This was an expression which he had carefully studied on all occasions, because he found it in nature.

When the drapery was to cover the leg or arm but half, or in an imperfect manner, he made it cut obliquely the member which was partly to be covered. His folds were of a triangular form. The reason of this form is in nature: for all drapery has a tendency to enlarge itself and be extended; and as at the same time its own weight obliges it to fall back on itself, it is naturally formed into triangles.

He knew perfectly that the movements of the body and of its members are the causes of the actual situation of drapery, and of the formation of its folds. All his practice is nothing else but the unfolding and demonstrating of this theory; and drapery executed in any other manner must be in a false and vicious taste.

Sect. VII. *Of Landscape and Architecture.*

When our young painter has made a sufficient progress in those principal branches of his art, the designing, perspective, colouring, and drapery of human figures, he should turn his thoughts to landscape and architecture; for, by studying them, he will render himself universal, and qualified to undertake any subject; so as not to resemble certain literati, who, though great masters in some articles, are mere children in every thing else.

The most eminent landscape painters are Poussin, Lorense, and Titian.

Poussin was remarkable for his great diligence. His pieces are quite exotic and uncommon; being set off with buildings in a beautiful but singular style; and with learned episodes, such as poets reciting their verses to the woods, and youths exercising themselves in the several gymnastic games of antiquity; by which it plainly appears, that he was more indebted for his subjects to the descriptions of Pausanias than to nature and truth.

Lorense applied himself chiefly to express the various phenomena of light, especially those perceivable in the heavens. And thanks to the happy climate of Rome, where he studied and exercised his talents, he has left us the brightest skies, and the richest and most gloriously cloud-tipt horizons, that can be well conceived. Nay, the sun himself, which, like the Almighty, can be represented merely by his effects, has scarcely escaped his daring and ambitious pencil.

Titian, the great confidant of nature, is the Homer of landscape. His scenes have so much truth, so much variety, and such a bloom in them, that it is impossible to behold them, without wishing, as if they were real, to make an excursion into them. And perhaps the finest landscape that ever issued from mortal hands, is the back ground of his *martyrdom of St Peter;* where, by the difference between the bodies and the leaves of his trees and the disposition of their branches, one immediately discovers the difference between the trees themselves; where the different soils are so well expressed, and so exquisitely clothed with their proper plants, that a botanist has much ado to keep his hands from them. See Part II. sect. ii.

Paolo Veronese is in architecture what Titian is in landscape. To excel in landscape, we must, above all things, study nature. To excel in architecture, we must chiefly regard the finest works of art; such as the fronts of ancient edifices, and the fabrics of those moderns who have best studied and best copied antiquity. Next to Brunelleschi and Alberti, who were the first revivers of architecture, came Bramante, Giulio Romano, Sansovino, Sanmicheli, and lastly Palladio, whose works the young painter should above all the rest diligently study and imprint deeply on his mind. Nor is Vignola to be forgotten; for some think he was a more scrupulous copier of antiquity, and more exact, than Palladio himself, insomuch that most people consider him as the first architect among the moderns. For our part, to speak of him, not as fame, but as truth seems to require, we cannot help thinking, that rather than break through the generality of the rules contrived by him to facilitate practice, he has in some instances deviated from the most beautiful proportions of the antique, and is rather barren in the distribution and disposition of certain members. Moreover, the extraordinary height of his pedestals and cornices hinders the column from showing in the orders designed and employed by him, as it does in those of Palladio. Amongst that great variety of proportions to be met with in ancient ruins, Palladio has been extremely happy in choosing the best. His profiles are well contrasted, yet easy. All the parts of his buildings hang well together. Grandeur, elegance, and beauty, walk hand in hand in them. In short, the very blemishes of Palladio, who was no slave to conveniency, and sometimes perhaps was too profuse in his decorations, are picturesque. And we may reasonably believe, that it was by following so great a master, whose works he had continually before his eyes, that Paolo Veronese formed that fine and masterly taste which enabled him to embellish his compositions with such beautiful structures.

The study of architecture cannot fail, in another respect, of being very useful to the young painter, inasmuch as it will bring him acquainted with the form of the temples, thermæ, basilics, theatres, and other buildings of the Greeks and Romans. Besides, from the basso-relievos with which it was customary to adorn these buildings, he may gather with equal delight and profit, the nature of their sacrifices, arms, military ensigns, and dress. The study of landscape, too, will render familiar to him the form of the various plants peculiar to each soil and climate, and such other things as serve to characterise the different regions of the earth. Thus by degrees he will learn what we call *costume,* one of the chief requisites in a painter; since by means of it he may express with great precision the time and place in which his scenes are laid.

Expression of the Passions.

SECT. VIII. *Of the Expression of the Passions.*

THAT language which above all others a painter should carefully endeavour to learn, and from nature herself, is the language of the passions. Without it the finest works must appear lifeless and inanimate. It is not enough for a painter to be able to delineate the most exquisite forms, give them the most graceful attitudes, and compose them well together; it is not enough to dress them out with propriety, and in the most beautiful colours; it is not enough, in fine, by the powerful magic of light and shade, to make the canvas vanish. No; he must likewise know how to clothe his figures with grief, with joy, with fear, with anger; he must, in some sort, write on their faces what they think and what they feel; he must give them life and speech. It is indeed in this branch that painting truly soars, and in a manner rises superior to itself; it is in this branch she makes the spectator apprehend much more than what she expresses.

The means employed in her imitations by painting, are the circumscription of terms, the chiaro-scuro, and colours; all which appear solely calculated to strike the visual faculty. Notwithstanding which, she contrives to represent hard and soft, rough and smooth surfaces, which are objects of the touch: and this by means of certain tints, and a certain chiaro-scuro, which has a different look in marble, in the bark of trees, in downy and delicate substances. Nay, she contrives to express sound and motion, by means of light and shade, and certain particular configurations. In some landscapes of Diderich we almost hear the water murmur, and see it tremble along the sides of the river and of the boats upon it. In the *Battle* of Burgogne, we are really apt to fancy that the trumpet sounds; and we see the horse, who has thrown his rider, scamper along the plain. But what is still more wonderful, painting, in virtue of her various colours and certain particular gestures, expresses even the sentiments and most hidden affections of the soul, and renders her visible, so as to make the eye not only touch and hear, but even kindle into passion and reason.

Many have written, and amongst the rest the famous Le Brun, on the various changes that, according to the various passions, happen in the muscles of the face, which is, as it were, the dumb tongue of the soul. They observe, for example, that in fits of anger the face reddens, the muscles of the lips puff out, the eyes sparkle; and that, on the contrary, in fits of melancholy, the eyes grow motionless and dead, the face pale, and the lips sink in. It may be of service to a painter to read these and such other remarks; but it will be of infinitely more service to study them in nature itself, from which they have been borrowed, and which exhibits them in that lively manner which neither tongue nor pen can express.

Upon Le Brun's Treatise on the Passions, we have the following just, though severe, criticism by Winckleman. "Expression, though precarious in its nature (says he), has been reduced into a system, in a Treatise on the Passions by Charles le Brun, a work generally put into the hands of young artists. The plates which accompany this treatise do not only give to the face the affections of the soul in too high a tone, but there are many of the heads in which the passions are represented in an outrageous manner. He appears to give instructions in expression, as Diogenes gave examples of morality: I act like musicians, said that cynic, who give a high tone, in order to indicate a true one. But the fervour of youth has naturally more inclination to seize the extreme than the middle; and hence it is difficult for the young artist, in copying after Le Brun, to seize the true tone. Youth in general may be supposed to have that regard for the calm and moderate in the arts, which they have for the precepts of wisdom and virtue."

Other French writers have given instructions respecting the expression of the passions, equally exceptionable with those of Le Brun. All of them whom we have consulted make so many divisions and subdivisions of passions, that a philosopher cannot follow them in metaphysical theory, nor a painter exhibit their effects upon canvas. Nature therefore must be his guide, particularly in treating those very minute and almost imperceptible differences, by which, however, things very different from each other are often expressed. This is particularly the case with regard to the passions of laughing and crying; as in these, however contrary, the muscles of the face operate nearly in the same manner. As the famous Pietro de Cortona was one day finishing the face of a crying child in a representation of the Iron Age, with which he was adorning the floor called the *Hot-bath* in the royal palace of Pitti, Ferdinand II. who happened to be looking over him for his amusement, could not forbear expressing his approbation, by crying out, "Oh how well that child cries!" To whom the artist,—"Has your majesty a mind to see how easy it is to make children laugh? Behold, I'll prove it in an instant:" And taking up his pencil, by giving the contour of the mouth a concave turn downwards instead of the convex upwards which it before had, and with little or no alteration in any other part of the face, he made the child, who a little before seemed ready to burst its heart with crying, appear in equal danger of bursting its sides with immoderate laughter; and then, by restoring the altered features to their former position, he soon set the child a-crying again."

Lectures of Philip Baldinucci in the Academy of La Crusca il Lystrato, &c.

The different expressions of laughter and weeping are thus described by Le Brun. "The movements of laughter are expressed by the eye-brows elevated towards the middle of the eye, and lowered towards the sides of the nose: the eyes, almost shut, appear sometimes moistened with tears: the mouth, a little open, allows the teeth to be seen: the extremities of the mouth drawn back, make a dimple in the cheeks, which appear to be swelled: the nostrils are open: and the face becomes red. The changes which weeping occasions are equally visible. The eye-brow is lowered on the middle of the forehead; the eyes are almost shut, moistened, and lowered towards the sides of the cheeks: the nostrils are swelled, and the veins of the forehead very apparent: the mouth shut, by the lowness of its sides, occasions wrinkles in the cheeks; the under lip is turned down, and presses at the same time the upper lip: the whole contenance is wrinkled and becomes red; especially the eye-brows, the eyes, the nose, and the cheeks."

According to Leonardo da Vinci, the best masters that

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that a painter can have recourse to in this branch are those dumb men who have found out the method of expressing their sentiments by the motion of their hands, eyes, eye-brows, and in short every other part of the body. If this advice be at all proper, such gestures must be imitated with great sobriety and moderation, lest they should appear too strong and exaggerated; and the piece should show nothing but pantomimes, when speaking figures alone are to be exhibited; and so become theatrical and second-hand, or, at best, look like the copy of a theatrical and second-hand nature.

The artist will reap greater benefit from studying such fine ancient heads as those of Mithridates, Seneca, Alexander dying, Cleopatra, Niobe, &c. and above all, from attentively observing such movements of nature as we daily meet with in the world. But let him chiefly consult his looking-glass, and study after his own face, what, in certain expressions, are the muscles, the lineaments, the tints, and the accidental circumstances which characterise the situation of the soul. It rarely happens that a model, which is affected with no sentiment, presents that to us which we ourselves feel, and which we are capable of expressing when we are our own model. Puget executed the legs of his Milo after his own; and many ingenious artists have had recourse to a similar expedient. In short, to be affected ourselves is the true secret of affecting the spectator.

We must not neglect, at the same time, to secure the fleeting characters which nature presents to us on a thousand occasions. We must distrust our memory, and all the resources which are not easily employed when we happen to stand in need of them. It is necessary to watch the circumstances from which we can derive any useful hint; to seize them when they present themselves; and to be careful never to lose, by an irreparable negligence, the fruit of a happy incident.

Let us also endeavour to possess the feeling of what we are to express: whether it be by forming the image of a thing absent as if it were present, or by being affected with the lively idea of a situation which we have either experienced, or with which we have seen another person remarkably affected. We must never forget, that all the terrible or agreeable, the violent or slight movements, are to be treated in a natural manner, and bear a relation to the age, condition, sex, and dignity of the person. Those gradations, which art varies according to the nature of the situation, and the character of men, compose the principal ingredients of discernment, knowledge, and taste. They have been the objects of attention and inquiry to the most eminent painters of every age; and they were of the last importance in assisting them to arrive at that degree of excellence to which they have carried expression.

We are told strange things of the ancient painters of Greece in regard to expression; especially of Aristides; who, in a picture of his, representing a woman wounded to death at a siege, with a child crawling to her breast, makes her appear afraid, lest the child, when she was dead, should, for want of milk, suck her blood. *A Medea murdering her children*, by Timomachus, was likewise much cried up, as the ingenious artist contrived to express, at once, in her countenance, both the fury that hurried her on to the commission of so great a crime, and the tenderness of a mother that seemed to withhold her from it. Rubens attempted to express such a double effect in the face of Mary of Medicis, still in pain from her past labour, and at the same time full of joy at the birth of a Dauphin. And in the countenance of Sancta Polonia, painted by Tiepolo for St Anthony's church at Padua, one may clearly read a mixture of pain from the wound given her by the executioner, and of pleasure from the prospect of paradise opened to her by it.

Few, to say the truth, are the examples of strong expressions afforded by the Venetian, Flemish, or Lombard schools. Deprived of that great happiness, the happiness of being able to contemplate, at leisure, the works of the ancients, the purest sources of perfection in point of design, expression, and character; and having nothing but nature constantly before their eyes; they made strength of colouring, blooming complections, and the grand effects of the chiaro-obscuro, their principal study: they aimed more at charming the senses than at captivating the understanding. The Venetians, in particular, seem to have placed their whole glory in setting off their pieces with all that rich variety of personages and dress, which their capital is continually receiving by means of its extensive commerce, and which attracts so much the eyes of all those who visit it. It is much to be doubted, if, in all the pictures of Paolo Veronese, there is to be found a bold and judicious expression, or one of those attitudes which, as Petrarch expresses it, speak without words; unless, perhaps, it be that remarkable one in his *Marriage Feast of Cana of Galilee*. At one end of the table, and directly opposite to the bridegroom, whose eyes are fixed upon her, there appears a woman in red, holding up to him the skirts of her garment; as much as to say, we may suppose, that the wine miraculously produced was exactly of the colour with the stuff on her back. And in fact it is red wine we see in the cups and pitchers. But all this while the faces and attitudes of most of the company betray not the least sign of wonder at so extraordinary a miracle. They all, in a manner, appear intent upon nothing but eating, drinking, and making merry. Such, in general, is the style of the Venetian school. The Florentine, over which Michael Angelo presided, above all things curious of design, was most minutely and scrupulously exact in point of anatomy. On this she set her heart, and took singular pleasure in displaying it. Not only elegance of form, and nobleness of invention, but likewise strength of expression, triumph in the Roman school, nursed as it were amongst the works of the Greeks, and in the bosom of a city which had once been the seminary of learning and politeness. Here it was that Domenichino and Poussin, both great masters of expression, refined themselves, as appears more particularly by the *St Jerome* of the one, and the *Death of Germanicus*, and the *Slaughter of the Innocents*, by the other. Here it was that Raphael arose, the sovereign master of them all. One would imagine that pictures, which are generally considered as the books of the ignorant, and of the ignorant only, he had undertaken to make the instructors even of the learned. One would imagine, that he intended in some measure, to justify Quintilian *, who affirms, that painting has more power over us than all the arts of rhetoric. There is not, indeed, a single picture

* Inst. lib. xi. c.

Expression of the Passions

ture of Raphael's, from the study of which those who are curious in point of expression may not reap great benefit; particularly his *Martyrdom of St Felicitas*, his *Transfigurations*, his *Joseph explaining to Pharaoh his dream*, a piece so highly rated by Poussin. His *School of Athens* in the Vatican, is, to all intents and purposes, a school of expression. Among the many miracles of art with which this piece abounds, we shall single out that of the four boys attending on a mathematician, who, stooping to the ground with his compasses in his hand, is given them the demonstration of a theorem. One of the boys, recollecting within himself, keeps back, with all the appearance of profound attention to the reasoning of the master; another, by the briskness of his attitude, discovers a greater quickness of apprehension; while the third, who has already seized the conclusion, is endeavouring to beat it into the fourth, who, standing motionless, with open arms, a staring countenance, and an unspeakable air of stupidity in his looks, will never perhaps be able to make any thing of the matter. And it is probable from this very group that Albani, who studied Raphael so closely, drew the following precept of his; "That it behoves a painter to express more circumstances than one by every attitude; and so to employ his figures, that, by barely seeing what they are actually about, one may be able to guess, both what they have been already doing, and are next going to do." This is indeed a difficult precept; but it is only by a due observance of it that the eye and the mind can be made to hang in suspense on a painted piece of canvas. It is expression that a painter, ambitious to soar in his profession, must, above all things, labour to perfect himself in. It is the last goal of his art, as Socrates proves to Parrhasius, It is in expression that dumb poetry consists, and what the prince of our poets calls a visible language.

Xenoph. Memorab. lib. iii.

Sect. IX. *Of Invention.*

As the operations of a general should all ultimately tend to battle and conquest, so should all the thoughts of a painter to perfect invention. Now, the studies which we have been hitherto recommending, will prove so many wings by which he may raise himself, as it were, from the ground, and soar on high, when desirous of trying his strength this way, and producing something from his own hand. Invention is the finding out probable things, not only such as are adapted to the subject on hand, but such, besides, as by their sublimity and beauty are most capable of exciting suitable sentiments in the spectator, and of making him, when they happen to be well executed, fancy that it is the subject itself in its greatest perfection, and not a mere representation of it, that he has before him. We do not say true things, but probable things; because probability or verisimilitude is, in fact, the truth of those arts which have the fancy for their object. It is, indeed, the business and duty of both naturalists and historians to draw objects as they find them, and represent them with all those imperfections and blemishes, to which, as individuals, they are subject. But an ideal painter, and such alone is a true painter, resembles the poet: instead of copying, he imitates: that is, he works with his fancy, and represents objects endued with all that perfection

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which belongs to the species, and may be conceived in the archetype.

"'Tis nature all, but nature methodis'd;"

says an eminent poet, speaking of poetry: And the same may be said of painting; it is nature methodised, and made perfect. Insomuch that the circumstances of the action, exalted and sublimed to the highest degree of beauty and boldness they are susceptible of, may, though possible, have never happened exactly such as the painter fancies and thinks proper to represent them. Thus, the piety of Æneas, and the anger of Achilles, are things so perfect in their kind, as to be merely probable. And it is for this reason that poetry, which is only another word for invention, is more philosophical, more instructive, and more entertaining, than history.

Here it is proper to observe, what great advantages the ancient had over the modern painters. The history of the times they lived in, fraught with great and glorious events, was to them a rich mine of the most noble subjects, which, besides, often derived no small sublimity and pathos from the mythology upon which their religion was founded. So far were their gods from being immaterial, and placed at an infinite distance from their worshippers; so far was their religion from recommending humility, penance, and self-denial, that, on the contrary, it appeared calculated merely to flatter the senses, inflame the passions, and poison the fancy. By making the gods partake of our nature, and subjecting them to the same passions, it gave man hopes of being able to mix with those who, though greatly above him, resembled him, notwithstanding, in so many respects. Besides, those deities of theirs were in a manner visible, and to be met at every step. The sea was crowded with Tritons and Nereids, the rivers with Naiads, and the mountains with Dryads. The woods swarmed with Fauns and Nymphs, who, in those obscure retreats, sought an asylum for their stolen embraces. The most potent empires, the most noble families, the most celebrated heroes, all derived their pedigree from the greater divinities. Nay, gods interested themselves in all the concerns of mankind. Apollo, the god of long arrows, stood by the side of Hector in the fields of Troy, and inspired him with new strength and courage to batter down the walls and burn the ships of the Greeks. These, on the other hand, were led on to the fight and animated by Minerva, preceded by Terror, and followed by Death. Jove nods, his divine locks shake on his immortal head; Olympus trembles. With that countenance, which allays the tempest, and restores serenity to the heavens, he gathers kisses from the mouth of Venus, the delight of gods and of men. Among the ancients, every thing sported with the fancy; and in those works which depend entirely on the imagination, some of our greatest masters have thought they could not do better than borrow from the Pagans, if we may be allowed to say it, their pictures of Tartarus, in order to render their own drawings of hell more striking.

After all, there have not been wanting able inventors in painting among the moderns. Michael Angelo, notwithstanding the depth and boldness of his own fancy, is not ashamed in some of his compositions, to *Dantise*; as Phidias and Apelles may be said formerly to have

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Homerized. Raphael, too, tutored by the Greeks, has found means, like Virgil, to extract the quintessence of truth; has seasoned his works with grace and nobleness; and exalted nature, in a manner, above herself, by giving her an aspect more beautiful, more animating, and more sublime, than she is in reality accustomed to wear. In point of invention, Domenichino and Hannibal Caracci come very near Raphael, especially in the pieces painted by them in Rome; nor does Poussin fall very short of him in some of his pictures, particularly in his *Esther before Ahasuerus*, and his *Death of Germanicus*, the richest jewel belonging to the Barberine family. Of all the painters who have acquired any extraordinary degree of reputation, no one studied less to set off his pieces by bold and beautiful circumstances, or was more a stranger to what is called *poetical perfection*, than Jacopo Bassano. Among the numberless instances we could produce of his carelessness this way, let it suffice to mention a *Preaching of St Paul* painted by him in a place, near that of his birth, called *Marostego*. Instead of representing the apostle full of a divine enthusiasm, as Raphael has done, and thundering against the superstitions of the heathen in an assembly of Athenians; instead of exhibiting one of his auditors struck to the quick, another persuaded, a third inflamed; he makes him hold forth, in a village of the Venetian state, to a parcel of poor peasants and their wives, who take not the least notice of him; the women especially, who seem to mind nothing but the country labours in which he had found them employed.

With regard to invention, painting and poetry resemble each other so much in many other respects, besides that of combining in every action all the beauty and elegance it will admit, that they well deserve the name of *sister arts*. They differ, however, in one point, and that too of no small importance. It is this. The poet, in the representation of his story, relates what has already happened, prepares that which is still to come, and so proceeds, step by step, through all the circumstances of the action; and, to produce the greater effect on his hearers, avails himself of the succession of time and place. The painter, on the contrary, deprived of such helps, must be content to depend upon one single moment. But what a moment! A moment, in which he may conjure up, at once, to the eyes of the spectator, a thousand objects; a moment, teeming with the most beautiful circumstances that can attend the action; a moment, equivalent to the successive labours of the poet. This the works of the greatest masters, which are everywhere to be seen, sufficiently evince: among others, the *St Paul at Lystra*, by Raphael, whom it is impossible not to praise as often as this picture is mentioned. In order to give the spectator a thorough insight into the subject of this piece, the painter has placed in the front of it the cripple already restored to his limbs by the apostle, fired with gratitude towards his benefactor, and exciting his countrymen to yield him all kinds of honour. Round the cripple are some figures lifting up the skirts of his coat, in order to look at the legs reduced to their proper shape, and acknowledging by gestures full of astonishment the reality of the miracle; an invention, says a certain author, a professed admirer of antiquity, which might have been proposed as an example in the happiest age of Greece.

Webb, dial. 7.

We have another shining instance of the power of painting to introduce a greater variety of objects on the scene at the same time, and of the advantage it has in this respect over poetry, in a drawing by the celebrated La Fage. This drawing represents the descent of Æneas into hell. The field is the dark caverns of Pluto's kingdom, through the middle of which creeps slowly the muddy and melancholy Acheron. Nearly in the centre of the piece appears Æneas with the golden bough in his hand, and with an air of astonishment at what he sees. The Sibyl, who accompanies him, is answering the questions which he asks her. The personage there is the ferryman of the pitchy lake, by which even the gods themselves are afraid to swear. Those who, crowding in to the banks of the river, numberless as the leaves shaken off the trees by autumnal blasts, express, with outstretched hands, an impatience to be ferried to the opposite shore, are the unhappy manes, who, for want of burial, are unqualified for that happiness. Charon, accordingly, is crying out to them, and with his lifted-up oar driving them from his boat, which has already taken in a number of those who had been honoured with the accustomed funeral rites. Behind Æneas and the Sibyl we discover a confused group of wretched souls, lamenting bitterly their misfortune in being denied a passage; two of them wrapped up in their clothes; and, in a fit of despair, sunk upon a rock. Upon the first lines of the piece stands a third group of uninhumed shades. Leucaspes, Orontes, and, in the midst of them, the good old Palinurus, formerly master and pilot of the hero's own vessel, who with joined hands most earnestly desires to be taken along with him into the boat, that after death, at least, he may find some repose, and his dead body no longer remain the sport of winds and waves. Thus, what we see scattered up and down in many verses by Virgil, is here, as it were, gathered into a focus, and concentrated by the ingenious pencil of the painter, so as to form a subject well worthy of being exposed, in more shapes than one, to the eyes of the public.

When a painter takes a subject in hand, be it historical, be it fabulous, he should carefully peruse the books which treat of it, imprint well on his mind all the circumstances that attend it, the persons concerned in it, and the passions with which they must have been severally animated; not omitting the particulars of time and place. His next business is to create it, as it were, anew, observing the rules already laid down for that purpose: From what is true, choosing that which is most striking; and clothing his subject with such accessory circumstances and actions, as may render it more conspicuous, pathetic, and noble, and best display the powers of the inventive faculty. But, in doing this, great discretion is requisite; for, let his imagination grow ever so warm, his hand is never to execute any thing that is not fully approved by his judgement. Nothing low or vulgar should appear in a lofty and noble argument; a fault, of which some of the greatest masters, even Lampieri and Poussin, have been now and then guilty.

The action must be one, the place one, the time one. We need not say any thing of those painters, who, like the writers of the Chinese and Spanish theatre, cram a variety of actions together, and so give us at once the whole life of a man. Such blunders, it is presumed, are too gross to be feared at present. The

politeness

Invention. politeness and learning of the age seem to demand considerations of a more refined nature; such as, that the episodes introduced in the drama of a picture, the better to fill and adorn it, should be not only beautiful in themselves, but indispensably requisite. The games celebrated at the tomb of Anchises, in Sicily, have a greater variety in them, and more sources of delight, than those that had been before celebrated at the tomb of Patroclus under the walls of Troy. The arms forged by Vulcan for Æneas, if not better tempered, are at least better engraved, than those which the same god had forged several ages before for Achilles. Nevertheless, in the eyes of judges, both the games and the arms of Homer are more pleasing than those of Virgil, because the former are more necessary in the Iliad than the latter in the Æneid. Every part should agree with, and have a relation to, the whole. Unity should reign even in variety; for in this beauty consists. This is a fundamental maxim in all the arts whose object it is to imitate the works of nature.

Pictures often borrow no small grace and beauty from the fictions of poetry. Albani has left us, in several of his works sufficient proofs of the great share the belles lettres had in refining his taste. But Raphael, above all others, may in this branch too be considered as a guide and master. To give but one instance out of many; what a beautiful thought was it to represent the river himself, in a *Passage of Jordan*, supporting his waters with his own hands, in order to open a way to the army of the Israelites! Nor has he displayed less judgment in reviving, in his designs engraved by Agostino of Venice, the little loves of Aëtius playing with the arms of Alexander, conquered by the beauty of Roxana.

Among the ancients, Apelles and Parrhasius were those who distinguished themselves most in allegorical subjects, in which the inventive faculty shows itself to the greatest advantage; the first by his picture of *Calumny* *, the second by that of the *Genius of the Athenians* †. The ancient painter called *Galaton* gave likewise a fine proof of his genius in this branch, by representing a great number of poets greedily quenching their thirst in the waters gushing from the mouth of the sublime Homer. And to this allegory, according to Guigni, Pliny ‡ has an eye, when he calls that prince of poets the *fountain of wits*. But it is, after all, no way surprising that we should often meet such fine flights of fancy in the ancient artists. They were not guided in their works by a blind practice: they were men of polite education, conversant with the letters of the age in which they lived; and the companions rather than the servants of the great men who employed them. The finest allegorical painter among the moderns was Rubens; and he was accordingly much celebrated for it. The best critics, however, find fault with his uniting in the Luxemburg gallery, the queen-mother, in council, with two cardinals and Mercury. Nor is there less impropriety in his making Tritons and Nereids, in another piece of the same gallery, swim to the queen's vessel through the galleys of the knights of St Stephen. Such freedoms are equally disgusting with the prophecies of Sannazaro's Proteus, concerning the mystery of the incarnation, or the Indian kings of Camoens, reasoning with the Portuguese on the adventures of Ulysses.

* See *Lucian* upon Calumny; and *Carlo Dati*, in the *Life of Apelles*, note 20.

† *C. Plinii Nat. Hist.* lib. xxxv. c. 10.

‡ *Plinii Nat. Hist.* lib. xvii. c. 5. *Webb*, dial. 4.

Polym. dial. 18.

The best modern performances in picturesque allegory are certainly those of Poussin; who availed himself, with great discretion and judgment, of the vast treasures with which, by a close study of the ancients, he had enriched his memory. On the other hand, Le Brun, his countryman, has been very unhappy this way. Ambitious to have every thing his own, instead of allegories, he has filled the gallery of Versailles with enigmas and riddles, of which none but himself was qualified to be the Oedipus. Allegory must be ingenious, it is true; but then it must be equally perspicuous; for which reason, a painter should avoid all vague and indeterminate allusions, and likewise those to history and heathen mythology, which are too abstruse to be understood by the generality of spectators. The best way, perhaps, to symbolize moral and abstract things, is to represent particular events: as Caracci did, by advice of Monsignore Agucchi, in the Farnesian palace. For example, what can better express a hero's love towards his country, than the virtuous Decius consecrating himself boldly to the infernal gods, in order to secure victory to his countrymen over their enemies? What finer emblems can we desire of emulation, and an insatiable thirst for glory, than Julius Cæsar weeping before the statue of Alexander in the temple of Hercules at Gades; of the inconstancy of fortune, than Marius sitting on the ruins of Carthage, and receiving, instead of the acclamations of an army joyfully saluting him imperator, orders from a lictor of Sextilius to quit Africa; of indiscretion, than Candaules, who, by showing the naked beauties of his wife to his friend Gyges, kindled a passion that soon made him repent his folly? Such representations as these require no comment; they carry their explanations along with them. Besides, supposing, and it is the worst we can suppose, that the painter's aim in them should happen not to be understood, his piece would still give delight. It is thus that the fables of Ariosto prove so entertaining, even to those who understand nothing of the moral couched under them; and likewise the Æneis, though all do not comprehend the allusions and double intent of the poet.

See *Bellori's Life of Caracci*.

Sect. X. *Of Disposition.*

So much for invention. *Disposition*, which may be considered as a branch of invention, consists in the proper stationing of what the inventive faculty has imagined, so as to express the subject in the most lively manner. The chief merit of disposition may be said to consist in that disorder, which, wearing the appearance of mere chance, is in fact the most studied effect of art. A painter, therefore, is equally to avoid the dryness of those ancients who always planted their figures like so many couples in a procession, and the affectation of those moderns who jumble them together as if they were met merely to fight and squabble. In this branch Raphael was happy enough to choose the just medium, and attain perfection. The disposition of his figures is always exactly such as the subject requires. In the *Battle of Constantine*, they are confusedly clustered with as much art, as they are regularly marshalled in *Christ's commitment of the keys to St Peter*, and constituting him prince of the apostles.

Let the inferior figures of a piece be placed as they will, the principal figure should strike the eye most, and stand

Disposition. stand out, as it were, from among the rest. This may be effected various ways, as by placing it on the foremost lines, or in some other conspicuous part of the piece; by exhibiting it, in a manner, by itself; by making the principal light fall upon it; by giving it the most resplendent drapery; or, indeed, by several of these methods, nay, by all of them together. For, being the hero of the picturesque fable, it is but just that it should draw the eye to itself, and lord it, as it were, over all the other objects.

According to Leon Batista Alberti, painters should follow the example of comic writers, who compose their fable of as few persons as possible. For, in fact, a crowded picture is apt to give as much pain to the spectator, as a crowded road to the traveller.

Some subjects, it must be granted, require a number, nay, a nation, as it were, of figures. On these occasions, it depends entirely on the skill of the painter to dispose of them in such a manner, that the principal ones may always make the principal appearance; and contrive matters so that the piece be not overcrowded, or want convenient rests and pauses. He must, in a word, take care that his piece be full, but not charged. In this respect, the *Battles of Alexander* by Le Brun are masterpieces which can never be sufficiently studied; whereas nothing, on the other hand, can be more unhappy than the famous *Paradise* of Tintoret, which covers one entire side of the great council-chamber at Venice. It appears no better than a confused heap of figures, a swarm, a cloud, a chaos, which pains and fatigues the eye. What a pity it is that he did not dispose this subject after a model of his own, now in the gallery of Bevilacqua at Verona! In this last the several choirs of martyrs, virgins, bishops, and other saints, are judiciously thrown into so many clusters, parted here and there by a fine fleece of clouds, so as to exhibit the innumerable host of heaven drawn up in a way that makes a most agreeable and glorious appearance. There goes a story, to our purpose, of a celebrated master, who in a drawing of the Universal Deluge, the better to express the immensity of the waters that covered the earth, left a corner of his paper without figures. Being asked, if he did not intend to fill it up: No, said he; do not you see my leaving it empty is what precisely constitutes the picture?

The reason for breaking a composition into several groups is, that the eye, passing freely from one object to another, may the better comprehend the whole. But the painter is not to stop here; for these groups are, besides, to be so artfully put together, as to form rich clusters, give the whole composition a singular air of grandeur, and afford the spectator an opportunity of discerning the piece at a distance, and taking the whole in, as it were, at a single glance. These effects are greatly promoted by a due regard to the nature of colours, so as not to place together those which are apt to pain by their opposition, or distract by their variety. They should be so judiciously disposed as to temper and qualify each other.

A proper use of the chiaro-scuro is likewise of great service on this occasion. The groups are easily parted, and the whole picture acquires a grand effect, by introducing some strong falls of shade, and, above all, one principal beam of light. This method has been followed with great success by Rembrandt in a famous picture of his, representing the Virgin at the foot of the cross on Mount Calvary; the principal light darting upon her through a break of the clouds, while the rest of the figures about her stand more or less in the shade. Tintoret, too, acquired great reputation, as well by that briskness with which he enlivened his figures, as by his masterly manner of shading them; and Polidoro de Caravaggio, though he scarcely painted any thing but basso-relievos, was particularly famous for introducing with great skill the effects of the chiaro-scuro, a thing first attempted by Mantegna in his *Triumph of Julius Cæsar*. It is by this means that his compositions appear so strikingly divided into different groups, and, among their other perfections, afford so much delight, through the beautiful disposition that reigns in them. Disposition.

In like manner, a painter, by the help of perspective, especially that called *aërial*, the opposition of local colours, and other contrivances which he may expect to hit upon by studying nature, and those who have best studied her before him, will be able not only to part his groups, but make them appear at different distances, so as to leave sufficient passages between them.

But the greatest caution is to be used in the pursuit of the methods here laid down; especially in the management of the chiaro-scuro, that the effects attributed to light and shade, and to their various concomitants, may not run counter to truth and experience. This is a capital point. For this purpose, a painter would do well to make, in little figures, as Tintoret and Poussin used to do, a model of the subject that he intends to represent, and then illuminate it by lamp or candle light. By this means he may come to know with certainty, if the chiaro-scuro, which he has formed in his mind, does not clash with the reason of things. By varying the height and direction of his light, he may easily discover such accidental effects as are most likely to recommend his performance, and so establish a proper system for the illuminating it. Nor will he afterwards find it a difficult matter to modify the quality of his shades, by softening or strengthening them, according to the situation of his scene, and the quality of the light falling upon it. If it should happen to be a candle or lamp-light scene, he would then have nothing to do but consider his model well, and faithfully copy it.

In the next place, to turn a group elegantly, the best pattern is that of a bunch of grapes adopted by Titian. As, of the many grains that compose a bunch of grapes, some are struck directly by the light, and those opposite to them are in the shade, whilst the intermediate ones partake of both light and shade in a greater or less degree; so, according to Titian, the figures of a group should be so disposed, that, by the union of the chiaroscuro, several things may appear as it were but one thing. And in fact it is only from his having pursued this method, that we can account for the very grand effect of his pieces this way, in which it is impossible to study him too much.

The mannerists, who do not follow nature in the track of the masters just mentioned, are apt to commit many faults. The reason of their figures casting their shades in this or that manner seldom appears in the picture, or at least does not appear sufficiently probable. They are besides, wont to trespass all bounds in splashing their pieces with light, that is, in enlivening those parts which we usually term the deals of a picture. This method, no

Disposition.

no doubt, has sometimes a very fine effect; but it is, however, to be used with no small discretion, as otherwise the whole loses that union, that pause, that majestic silence, as Caracci used to call it, which affords so much pleasure. The eye is not less hurt by many lights scattered here and there over a picture, than the ear is by the confused noise of different persons speaking all together in an assembly.

Hogarth's Analysis of Beauty.

Guido Reni, who has imparted to his paintings that gaiety and splendor in which he lived, seems enamoured with a bright and open light; whereas Michael Angelo de Caravaggio, who was of a sullen and savage disposition, appears fondest of a gloomy and clouded sky: so that neither of them were qualified to handle indifferently all objects. The chiaro-scuro may likewise prove of great service to a painter in giving his composition a grand effect; but, nevertheless, the light he chooses must be adapted to the situation of the scene where the action is laid: nor would he be less faulty, who in a grotto or cavern, where the light entered by a chink, should make his shades soft and tender, than he who should represent them strong and bold in an open sky-light.

But this is by no means the only fault which mannerists are apt to be guilty of in historical pieces, and particularly in the disposition of their figures. To say nothing of their favourite group of a woman lying on the ground with one child at her breast, and another playing about her, and the like, which they generally place on the first lines of their pieces; nor of those half-figures in the back ground peeping out from the hollows contrived for them: they make a common practice of mixing naked with clothed figures; old men with young; placing one figure with its face towards you, and another with its back; they contrast violent motions with languid attitudes, and seem to aim at opposition in every thing; whereas oppositions never please, but when they arise naturally from the subject, like antitheses in a discourse.

As to foreshortened figures, too much affectation in using or avoiding them is equally blameable. The attitudes had better be composed than otherwise. It very seldom happens that there is any occasion for making them so impetuous as to be in danger of losing their equilibrium; a thing too much practised by some painters.

In regard to drapery, equal care should be taken to avoid that poverty, which makes some masters look as if, through mere penury, they grudged clothes to their figures; and that profusion which Albani imputed to Guido, saying, that he was rather a tailor than a painter. The ornaments of dress should be used with great sobriety; and it will not be amiss to remember what was once said to an ancient painter: "I pity you greatly: unable to make Helen handsome, you have taken care to make her fine."

Let the whole, in a word, and all the different parts of the disposition, possess probability, grace, costume, and the particular character of what is to be represented. Let nothing look like uniformity of manner; which does not appear less in the composition than it does in colouring, drapery, and design; and is, as it were, that kind of accent, by which painters may be as readily distinguished as foreigners are, by pronouncing in the same manner all the different languages they happen to be acquainted with.

Illusion.

Sect. XI. *Of Illusion.*

Among painters, and the writers on painting, there is one maxim universally admitted and continually inculcated; it is, that *nature ought to be imitated,* and objects are said to be represented naturally, when they have such relief that they may seem real. If we inquire to what degree painting may carry this illusion, we shall find that it deceives the eye, and obliges the spectator to employ the touch in mouldings and in basso-relievos where they are a little projected; but that it is weakened, and the effect partly destroyed where the projection is one or two feet. It is possible also to make it in the highest degree complete in pictures of flowers, fruits, and other representations of still life, provided they be seen in a certain point of view, and at a considerable distance; but there is no example of a picture containing a number of figures, and placed in a proper light, being mistaken for real life. We are told, indeed, of a bust of an abbé painted by Charles Coypel, which, placed in a certain direction behind a table, and in a certain light, deceived several persons so completely as to induce them to salute it: but, without admitting any thing very extraordinary in the projection or illusion of this painting, it is evident, from the circumstances attending the relation, that the deception arose from surprise and inattention, which might happen to a production of an inferior artist. And hence we may conclude that it is vain to pretend to perfect the illusion, especially in pictures consisting of a number of figures, and with considerable distances supposed between them.

Among the obstacles which are opposed to the perfection of this branch of the art, we shall chiefly attend to those which naturally proceed from our habits of thinking and judging on all occasions. These, together with the experience we daily have of light on all kinds of surfaces, and of all colours, are sufficient to demonstrate the want of reality in the mere representation of any scenes.

It has been elsewhere shewn, that distance, figure, and magnitude, are not naturally objects of perception by the sense of sight; that we judge of these things by the eye only, in consequence of associations early formed between the perceptions of touch and the corresponding impressions on the retina and optic nerve by the rays of light; and that a painter makes his picture resemble the original, merely by laying his colours on a plane surface in such a manner, as that they reflect the same rays of light with the convex or concave original, when the spectator stands at the proper distance (see Metaphysics, N° 49, 50, 51, 52, and 95.). But if this be admitted, illusion in painting can never be made perfect, on account of the inevitable falsity of the shades which mark the most distant parts of the picture. The painter can only imitate those shades by obscure colours, laid on a plane surface, and susceptible of reflecting the light with a degree of force relative to the real distance. Now our eyes give us the tree plane of this surface, opposed to the idea of deepening which the painter wishes to produce, a contrariety which prevents the deception. On this account, the faults found in the works of the greatest

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greatest masters, with regard to the effects produced by the whole, most frequently relate to their manner of shading, which is sufficient to prove, that the want of illusion in painting depends chiefly on the imperfection of the shades.

This defect, though it cannot be wholly avoided, may yet be rendered less perceptible. There has yet, indeed, been no painter able to imitate shadow, nor is it probable that any one will ever perfectly accomplish his task. Shadow in nature is not a body, but the privation of light, which destroys colours in a greater or less degree, in proportion as it is more or less complete. Now the painter can only imitate this privation and real darkness, by colours which must from their very nature be capable of reflecting light.—The colours may be more or less obscure, but they preserve always something which gives a mixture of reflection. To carry the imitation of shadow to the highest degree of perfection, it would be necessary to apply a colour capable of darkening all others, more or less as there should be occasion, and which might have no visible trace of its existence, that is, no one part of it which reflected one coloured ray more strongly than another. Perhaps this kind of negative colour might be found in practice to be of service to the art; but it would not render the surface totally invisible, for it would be necessary, farther, that it should have the property of not reflecting a single ray of light when exposed to it; which is altogether impossible, as there is no colour or body in nature without reflection in such a situation.

We shall be further convinced of the impossibility of painting shadow, if we attend to the pictures of the greatest masters, with regard to the imitation of truth. Every part, when taken by itself, connected with light, or with demitints, presents a perfect imitation. Even the different degrees of light or the objects are sufficiently exact; but notwithstanding this assemblage of circumstances corresponding with truth, and of which the result should be perfect *illusion*, yet in considering the whole, we are never so completely deceived, as to take a picture for a reality; from which we may conclude, that the want of illusion proceeds almost entirely from the imperfection of shading.

Illusion then, in the strictest sense, cannot exist in painting; but there is another kind of illusion, perhaps improperly so called, which is one of the principal parts of the art, and worthy of the greatest attention: It is, that the picture shall resemble truth to such a degree, by the justness of its forms, by the combination of colours, and by all its general effects, that the image shall give all the pleasure to be expected from the imitation of truth. This is not illusion in the proper sense of the word, since it exists as well in pictures on a small scale as in those of equal dimensions with the original; but it is that truth of imitation of which painting is susceptible, even in pictures containing any numbers of figures at any reasonable distance from each other.

But it remains to be considered whether this imitation of truth, taken by itself, be the highest attainable perfection in painting. It is generally granted, that the greatest beauty is that which not only pleases at first view, but on the nearest and most critical examination. But if illusion, such as we have described it, were the sole merit of the art, it would follow, that the person who was least acquainted with its beauties would experience the same pleasure as he who had studied them most. Farther, in examining the works of the greatest masters, it is easy to perceive, that it is not their illusion which has excited the attention and admiration of the critic. Even the works of the divine Raphael do not deceive the eye in any point of view more completely than those of an ordinary painter. Raphael, pure in his character and design, is, without doubt, very deficient in this part of the art. Meanwhile the grandeur of his ideas in composition, and the choice of his forms; the beauty of his heads, wherein one does not admire simply the imitation of any known truth; his ingenious and noble manner in drapery, which yet does not resemble any known stuff, or the garb of any nation; in short, all his beauties are superior to the simple imitation of truth, and contradict the sentiment of the greatest pleasure arising from illusion.

If we pass to those who have pursued colouring with the greatest success, we shall find them, doubtless, approach nearer to illusion than those who have neglected it; and it is also a fact, that their works have been more universally admired.

At the same time it is not the illusion occasioned by colours which has altogether excited this admiration. The exquisite demitints and the freshness of Corregio and Titian, which excel the ordinary beauties of nature, and even imitate her most perfect productions, may perhaps not be considered as destroying illusion; but it is no less a fact, that weaker and less precious colouring would carry it to greater perfection. Besides, this large, easy, and exquisite manner of painting, this harmony, of which they have given us the best examples, are owing to qualities in them much more excellent than what would be sufficient to produce the simple imitation of truth. Guido, Cortona, and some others, appear to approach nearer to illusion. But even those masters prove by their works, that the most estimable beauties in painting do not all tend to this branch of the art; for notwithstanding the high character which they have gained, they are much inferior to Raphael, Corregio, and Titian, although the first failed in colouring and in the knowledge of the claro-obscuro, the second in point of correctness, and the third in the choice of noble subjects.

From this we may conclude, that the nearest resemblance to truth is not the sole object in painting; that it requires a superior degree of elevation by the art of adding beauty and perfection to the most exact resemblance; and that it is this art which distinguishes and characterizes extraordinary men.

If we run over the great branches of painting, we shall find a number of essential beauties different from those which are capable of carrying illusion to the greatest possible height. In composition, we principally admire the extent of genius, the choice of picturesque and graceful attitudes, the ingenious combination of groups, whether in uniting the light and shade in order to obtain the greatest effect, or in disposing a whole in such a manner as to make no part superfluous; and finally, that kind of practical talent by which the mind takes possession of nature, and forces it to produce all the beauties of which the art is susceptible. In this enumeration of particulars it is easy to perceive that the beauties of composition are very distant from those of illusion.

To

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To obtain illusion in design, there is no occasion for correctness nor taste beyond what is perceived in nature by the most ignorant spectator. And with regard to colouring, that is not always most admired which is most natural. What departs widely from truth, indeed, is not of consequence beautiful, but many qualities are required besides the simple imitation of truth. Freshness, ease, and transparency in certain tones, are deemed absolutely requisite; and the most esteemed colourists have carried their beauties in all these respects beyond what they have seen in nature. If some tones in the fleshy parts have approached towards vermilion, to a light-blue, or a silver-gray, they have made them more apparent; not only to point them out to the spectator, but to show their knowledge in the discovery and their art in painting them. This would have been going beyond the limits of perfection, if these had consisted in simple illusion.

The opposition of colour, of light, and of shade, would have been in this case also superfluous; for nature is always true, without any pointed attempt to make her more engaging. The suppression of certain lights, which truth would require, and which art extinguishes, in order to augment the harmony of effect, would be also worthy of censure, whatever pleasure would result from it.

Finally, one of the greatest beauties of the art, namely, the peculiar manner of a great master, has no relation to illusion. This is not even founded in nature, but depends on the genius or singularity of the artist. It is this manner which distinguishes the original of a great master from the most exact copy; and which charactérizes the talents of the artists so well, that the smallest part of the picture, and even the least interesting, is sufficient to discover the painter. The distinction between the beautiful and illusive in painting has made Sir Joshua Reynolds, in express terms, recommend a perfection superior to the imitation of nature. "The principle now laid down (says he), that the perfection of the art does not consist in mere imitation, is far from being new or singular. It is, indeed, supported by the general opinion of the enlightened part of mankind. The poets, orators, and rhetoricians of antiquity, are continually enforcing this position, that all the arts receive their perfection from an ideal beauty, superior to what is to be found in individual nature. They are ever referring to the practice of the painters and sculptors of their times, particularly Phidias the favourite artist of antiquity, to illustrate their assertions. As if they could not sufficiently express their admiration of his genius by what they knew, they have recourse to poetical enthusiasm. They call it inspiration; a gift from heaven. The artist is supposed to have ascended the celestial region to furnish his mind with this perfect idea of beauty. 'He (says Proclus) who takes for his model such forms as nature produces, and confines himself to an exact imitation of them, will never attain to what is perfectly beautiful. For the works of nature are full of disproportion, and fall short of the true standard of beauty. So that Phidias, when he formed his Jupiter, did not copy any object ever presented to his sight; but contemplated only that image which he had conceived in his mind from Homer's description.'

"It is not easy to define in what this great style consists, nor to describe by words the proper means of acquiring it, if the mind of the student should be at all capable of such an acquisition. Could we teach taste or genius by rules, they would be no longer taste and genius. But though there neither are nor can be any precise invariable rules for the exercise or the acquisition of these great qualities; yet we may truly say that they always operate in proportion to our attention in observing the works of nature, to our skill in selecting, and to our care in digesting, methodising, and comparing our observations. There are many beauties in our art that seem at first to lie without the reach of precept, and yet may easily be reduced to practical principles. Experience is all in all; but it is not every one that profits by experience: and most people err not so much from want of capacity to find their object, as from not knowing what object to pursue. This great ideal perfection and beauty are not to be sought in the heavens, but upon the earth. They are about us, and upon every side of us: But the power of discovering what is deformed in nature, or, in other words, what is particular or uncommon, can be acquired only by experience; and the whole beauty and grandeur of the art consists in being able to get above all singular forms, local customs, particularities, and details of every kind."

After these opinions, however, derived from the practice of the art, and this high authority, it may not be improper to hazard a few observations. Although illusion can be distinguished from many of the most excellent parts of the art taken separately, yet it does not follow that it shall not add in every picture to the beauty of the whole. It is impossible to state it in opposition to design, to composition, to colouring, or to the peculiar manner of a great artist; because all these may exist where there also exists the most perfect illusion. This is evident from the works of art: which have real relievo, and which at the same time are capable of perfection in all those branches, and of showing the peculiar manner of the artist. Again, it appears evident, that *illusion*, properly so called, should be a proper object of attention in painting. We may rate the ideal beauty very high, and with great justice; but it still consists in overcoming the defects in individual objects in nature, and not in departing from the truth of representation. And perhaps it may be alleged, that the impossibility of giving perfect illusion on a plane surface has pushed the greatest masters too far, and made them crowd artificial beauties into their pictures to conceal their want of power to give real ones. It is not improbable that on this very account the art is less perfect than otherwise it might have been: For in all subjects thought to be impossible, there is not only great room for exertion, but the person carries the art to greater perfection as he comes nearer to show that it may not be impossible. And if the works of Raphael, in point of illusion, are not superior to an ordinary artist, we may be permitted to say that there is great room for improvement in this branch.

Sect. XII. *Of the Costume.*

The costume in painting corresponds with the unities of time, place, and action, in tragedy and in epic poetry. It is chiefly confined to history painting; and regards the customs of different periods, the manners, the dress, and the colour, of different nations. Great exactness in the costume is scarcely practicable; but too sensible a departure

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departure from it denotes unpardonable negligence. It frequently happens that a piece composed of picturesque figures derives considerable advantage from certain liberties which are calculated to please both the artist and the spectator; for the judges of painting are not habitually occupied with the details of ancient and modern history, or profoundly versed in all the circumstances which make a departure from the costume conspicuous. On the other hand, if they were so ignorant as not to understand, or so indifferent as not to regard those circumstances, this branch of the art would be altogether arbitrary. The road of the painter is between these two extremes, not to despise beauty on the one hand, nor probability on the other. But in pursuing this part of the art, it is in vain to seek for perfect models in ancient or modern painting.

Manchester Transactions, vol. iii. p. 564. &c.

" When Raphael in his cartoons introduces monks and Swiss guards; when he puts into a boat more figures than it is evident the boat could actually contain; when in the chastisement of Heliodorus, who attempted to despoil the temple of Jerusalem, Pope Julius II. is depicted as being present; when, in the donation of Constantine in the Vatican, a naked boy is placed conspicuous in the fore ground astride upon a dog, in the immediate presence of the pope and the emperor; when Venetian senators are introduced while Pope Alexander excommunicates Barbarossa; when Aristotle, Plato, Dante, and Petrarch, are brought together in the school of Athens, to omit the lesser improprieties of shoeless apostles, &c.—every person must acknowledge that such offences as these against truths so obvious, if they do not arise from a defect of understanding, are instances of inexcusable carelessness.

" In like manner when the same great master paints the dreams of Joseph and his fellow prisoner in circles over their heads; when similar contrivances to express future events are used by Albani, Pameggiano, and Fuseli—is it not evident that no possibility can make the fiction true; and that real and feigned existences are unnaturally introduced in one narration?

" When Polydore chooses to represent the death of Cato, and exposes to the spectator the hero of the piece with his bowels gushing out; when Paul Veronese, at a banquet painted with his usual magnificence, places before us a dog gnawing a bone, and a boy making water: however such disgusting circumstances may be forgiven in the *chef d'œuvre* of a Michael Angelo, had he represented these instead of the horrible figures of his Day of Judgment, the performance of an inferior artist cannot atone for them.

" So also, when one of the first rate among the modern painters, we mean Paul Veronese, introduces Benedictine monks at the marriage of Cana; when, in a picture of the crucifixion, he puts the Roman soldiers in the jerkins of the 16th century, and adorns their heads with turbans; when Guido, in a painting of Jesus appearing to his mother after his resurrection, places St Charles Borromèe in a kind of desk in the back-ground as witness to the interview; when Tintoret, at the miraculous fall of manna, arms the Israelites with fusils; and Corregio appoints St Jerome as the instructor of the child Jesus—common sense revolts at the impropriety; and we are compelled to exclaim, *Quicquid ostendis mihi sic, incredulus odi!*

" The mythological taste of the learned Poussin is well known; but Rubens seems to claim the merit of having presented to the world a still greater number of supreme absurdities in this learned style: nor is it easy to conceive a more heterogeneous mixture of circumstances, real and imaginary, sacred and profane, than the Luxembourg gallery, and the other works of that great master, perpetually exhibit.

" When so high an authority as Sir Joshua Reynolds * contends for the rejection of common sense in favour of somewhat he terms a *higher sense*; when he laments, indirectly, that art is not in such high estimation with us, as to induce the generals, lawgivers, and kings of modern times, to suffer themselves to be represented naked, as in the days of ancient Greece; when he defends even the ridiculous aberrations from possibility, which the extravagant pencil of Rubens has so plentifully produced—it is not surprising that the artists of the present day should be led to reject the company of common sense; or that Sir Joshua's performances should furnish examples of his own precepts.

* Discourses, 8vo. p. 256.

" Mrs Siddons is represented by Sir Joshua in the character (as it is said) of the tragic muse: She is placed in an old-fashioned arm chair; this arm chair is supported by clouds, suspended in the air; on each side of her head is a figure not unapt to suggest the idea of the attendant imps of an enchantress: of these figures, one is supposed to represent Comedy, and the other Tragedy; Mrs Siddons herself is decently attired in the fashionable habilements of 20 or 30 years ago.

" If this be a picture of the tragic muse, she ought not to appear in a modern dress, nor ought she to be seated in an old arm chair. If this be a portraiture of Mrs Siddons, she has no business in the clouds, nor has she any thing to do with aerial attendants. If this be Mrs Siddons in the character of the tragic muse, the first set of objections apply; for she is placed in a situation where Mrs Siddons could never be.

" In the death of Dido, Sir Joshua Reynolds introduces her sister, lamenting over the corpse of the unfortunate queen. This is possible; but he has also introduced Atropos cutting Dido's hair with a pair of scissars, a being equally real and apparent in the painting with Dido or her sister. This (continues our author) appears to me a gross offence against mythological probability; nor is it the only offence against the costume with which that picture is chargeable.

" There is one other breach of the costume, however common among painters, more gross and offensive than any of the instances hitherto alleged; we mean the perpetual and unnecessary display of the naked figure. We shall not stay to inquire whether more skill can be shown in painting the human body clothed or unclothed. If the personages introduced in any picture are more naked in the representation than can be justified by the probability of the times, persons, places, or circumstances, it is a breach of the costume proportionate to the deviation. *This* fault, however, is so common as hardly to be noticed; so slight indeed, when compared with that general taste for voluptuous imagery and obscene representation, which has so long disgraced the art of painting in every stage of its progress, that science and morality are callous to the *slight* offence.

" This depravity of imagination, this prostitution of the pencil to the base purposes of lascivious inclination, was a subject of much complaint among the ancients.

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Nor is there less reason to complain in modern times, that this delightful art, which might be employed in exciting the noblest sentiments, and become subservient to the best interests of society, should so often be exercised upon subjects solely calculated to please the eye of the voluptuary and debauchee. It is hardly possible to pass through any admired collection without meeting with some of these; of which, however excellent the performance may be, the common feelings of decency and morality (if we are neither professed artists nor connoisseurs) prevent us from viewing them without a mixture of disgust."

Et pudor aversos texit velamine vultus *.

* *Abbe de Marsy.*

It is impossible to express how much a picture suffers by such looseness of fancy, and sinks as a bastard of the art in the esteem of good judges. Some people, indeed, are of opinion, that so scrupulous an observance of the costume is apt to hurt pictures, by depriving them of a certain air of truth, arising, they think, from those features and habits to which we are accustomed; and which are therefore apt to make a greater impression, than can be expected from things drawn from the remote sources of antiquity; adding withal, that a certain degree of licence has ever been allowed those artists who in their works must make fancy their chief guide. See, say they, the Greeks; that is, the masters of Raphael and Poussin themselves. Do they ever trouble their heads about such niceties? The Rhodian statuaries, for example, have not scrupled to represent Laocoon naked; that is, the priest of Apollo naked in the very act of sacrificing to the gods, and that too in presence of a whole people, of the virgins and matrons of Ilium. Now, continue they, if it was allowable in the ancient statuaries to neglect probability and decency to such a degree, to have a better opportunity of displaying their skill in the anatomy of the human body; why may it not be allowable in modern painters, the better to attain the end of their art, which is deception, to depart now and then a little from the ancient manners and the too rigorous laws of the costume? But these reasons, we beg leave to observe, are more absurd than they are ingenious. What! are we to draw conclusions from an example, which, far from deciding the dispute, gives occasion to another? The learned are of opinion, that those Rhodian masters would have done much better had they looked out for a subject in which, without offending so much against truth, and even probability, they might have had an equal opportunity of displaying their knowledge of the naked. And certainly no authority or example whatever should tempt us to do any thing contrary to what both decency and the reason of things require, unless we intend, like Carpioni, to represent

Sogni d'infermi, è fole di romanzi.
The dreams of sick men, and the tales of fools.

No: a painter, the better to attain the end of his art, which is deception, ought carefully to avoid mixing the antique with the modern, the domestic with the foreign; things, in short, repugnant to each other, and therefore incapable of gaining credit. A spectator will never be brought to consider himself as actually present at the scene, the representation of which he has before him, unless the circumstances which enter it perfectly agree among themselves, and the field of action, if we may use the expression, in no shape belies the action itself. For instance, the circumstances, or, if you please, the accessories, in a *Finding of Moses*, are not, surely, to represent the borders of a canal planted with rows of poppies, and covered with country-houses in the European taste; but the banks of a great river shaded with clusters of palm trees, with a Sphinx or an Anubis in the adjacent fields, and here and there in the back-ground a towering pyramid. And indeed the painter, before he takes either canvas or paper in hand, should, on the wings of fancy, transport himself to Egypt, to Thebes, or to Rome; and summoning to his imagination the physiognomy, the dress, the plants, the buildings, suitable to his subject, with the particular spot where he has chosen to lay his scene, so manage his pencil, as, by the magic of it, to make the enraptured spectators fancy themselves there along with him.

Proper Books for a Painter.

Sect. XIII. *Of Proper Books for a Painter.*

From what has been already said, it may be easily gathered, that a painter should be neither illiterate nor unprovided with books. Many are apt to imagine, that the Iconologia of Ripa, or some such collection, is alone sufficient for this purpose, and that all the apparatus he stands in need of, may be reduced to a few casts of the remains of antiquity, or rather to what Rembrandt used to call his *antiques*, being nothing more than coats of mail, turbans, shreds of stuff, and all manner of old household trumpery and wearing apparel. Such things, no doubt, are necessary to a painter, and perhaps enough for one who wants only to paint half-lengths, or is willing to confine himself to a few low subjects. But they are by no means sufficient for him who would soar higher; for a painter who would attempt the Universe, and represent it in all its parts, such as it would appear, had not matter proved refractory to the intentions of the sovereign Artist. Such a painter alone is a true, an universal, a perfect painter.——No mortal, indeed, must ever expect to rise to that sublimity; yet all should aspire to it, on the pain of otherwise ever continuing at a very mortifying distance from it: as the orator, who wishes to make a figure in his profession, should propose to himself no less a pattern than that perfect orator described by Tully; nor the courtier, than that perfect courtier delineated by Castiglione. It cannot, therefore, appear surprising, if we insist on the propriety of reckoning a good collection of books as part of such a painter's implements. The Bible, the Greek and Roman historians, the works of Homer, that prince of poets, and of Virgil, are the most classical. To these let him add the Metamorphoses of Ovid, some of our best poets, the voyage of Pausanias, Vinci, Vasari, and others, upon painting.

Algarotti on Painting.

It will also be of considerable advantage to him to have a well chosen collection of drawings by the best masters (D), in order to trace the progress and history of

(D) We have formerly (see *History of* Anatomy), mentioned a great anatomical work carrying on by Andrew

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of his art, and make himſelf acquainted with the various ſtyles of painting which have been, and now are, in the greateſt vogue. The prince of the Roman ſchool was not aſhamed to hang up in his ſtudy the drawings of Albert Durer; and ſpared no pains or expence to acquire all the drawings he could meet with that were taken from baſſo-relievos; things which the art of engraving has ſince rendered ſo common as to be in every one's hands. This art of multiplying drawings by means of the graver, is of the ſame date, and boaſts the ſame advantages, with the art of printing, by means of which the works of the mind are multiplied, as it were, at one ſtroke, and diſperſed over the whole world.

The ſight of fine ſubjects treated by able maſters, and the different forms which the ſame ſubjects aſſume in different hands, cannot fail both of enlightening and inflaming the mind of the young painter. The ſame may be ſaid of the peruſal of good poets and hiſtorians, with the particulars and proofs of what they advance; not to mention thoſe ideas and flights of invention, with which the former are wont to clothe, beautify, and exalt every thing they take in hand. Bouchardon, after reading Homer, conceived, to uſe his own words, that men were three times taller than before, and that the world was enlarged in every reſpect. It is very probable, that the beautiful thought of covering Agamemnon's face with the ſkirt of his mantle at the ſacrifice of Iphigenia, was ſuggeſted to Timantes by the tragedy of Euripides. And the ſublime conceit of Raphael, who, in a *Creation* of his, repreſents God in the immenſe ſpace, with one hand reaching to the ſun and the other to the moon, may be conſidered as the child of the following words of the Pſalmiſt: *The heavens declare the glory of God, and the firmament ſheweth his handy-work.*

This thought of Raphael has been, indeed, cenſured by Mr Webb. "A God (ſays this gentleman), extending one hand to the ſun, and another to the moon, deſtroys that idea of immenſity which ſhould accompany the work of creation, by reducing it to a world of a few inches." But the opinion of Count Algarotti is very different. "For my part, (ſays that elegant critic), I cannot diſcover in this painting a world of a few inches, but a world on a much greater ſcale; a world of millions and millions of miles: and yet this ſo immenſe a world, by means of that act of the Godhead, in which with one hand he reaches to the ſun, and with the other to the moon, ſhrinks, in my imagination, to a mere nothing, in reſpect to the immenſity of God himſelf; which is all that the powers of painting can pretend to. This invention is, though in a contrary ſenſe, of the ſame kind with that of Timantes, who, to expreſs the enormous ſize of a ſleeping Polyphemus, placed round him ſome ſatyrs meaſuring the monſter's thumb with a thyrſus. Hence Pliny, who relates the fact, takes occaſion to tell us, that his works always imply more than they expreſs; and that how great ſoever he may be in execution, he is ſtill greater in invention: *Atque in omnibus ejus operibus intelligitur plus ſemper quam pingitur; et cum ars ſumma ſit, ingenium tamen ultra artem eſt.*" Nat. Hiſt. lib. xxxv. c. 10.

The peruſal of good authors cannot but be very ſerviceable to a painter in another reſpect; as, among the great number of ſubjects afforded by hiſtory and poetry, he may expect to meet with many on which his talents may diſplay themſelves to the greateſt advantage. A painter can never be too nice in the choice of his arguments; for on the beauty of them that of his piece will greatly depend. How much to be pitied, therefore, were our firſt maſters, in being ſo often obliged to receive their ſubjects from the hands of ſimple and illiterate perſons! and what is worſe, to ſpend all the riches of their art upon barren or unworthy ſubjects! Such are the repreſentations of thoſe ſaints, who, though they never had the leaſt intercourſe with each other, and perhaps even lived in different ages, are, notwithſtanding to be introduced, *tete à tete*, as it were, into the ſame picture. The mechanic of the art may, indeed, diſplay itſelf on theſe occaſions: but by no means the ideal. The diſpoſition may be good and praiſe-worthy, as in the works of Cortoni and Lanfranc; but we are not to expect in them either invention or expreſſion, which require for their baſis the repreſentation of ſome fact capable of producing ſuch effects. Who does not, on the bare mention of this abuſe, immediately recollect many ſad inſtances of it? ſuch as the famous St Cecilia of Raphael, ſurrounded by St Paul, St Mary Magdalen, St John, and St Auguſtin; and the picture of Paolo Veroneſe, in the veſtry of the Nuns of St Zachary at Venice, in which St Francis of Aſſizium, St Catharine, and St Jerome richly habited in his cardinal's robes, form a ring round the Virgin ſeated on a throne with the child Jeſus in her arms; perhaps the moſt beautiful and picturesque of all the inſipid and inſignificant pieces with which Italy abounds. It is very ſhocking to think, that young painters ſhould be obliged to ſtudy their art from ſuch wretched compoſitions.

The ſubjects in which the pencil triumphs moſt, and with which a judicious painter may ſtock himſelf by the peruſal of good books, are, no doubt, thoſe which are moſt univerſally known, which afford the largeſt field for a diſplay of the paſſions, and contain the greateſt variety of incidents, all concurring, in the ſame point of time, to form one principal action. Of this the ſtory of Coriolanus beſieging Rome, as related by Livy, is a ſhining example. Nothing can be imagined more beautiful than the ſcene of action itſelf, which ought to take in the prætorium in the camp of the Volſcians, the Tiber behind it, and the ſeven hills, among which the towering Capitol is, as it were, to lord it over the reſt. It is impoſſible to conceive a greater variety, than what muſt appear in that crowd of ſoldiers, women, and children, all which are to enter the compoſition; unleſs, perhaps, it be that of the different paſſions with which they are ſeverally agitated; ſome wiſhing that Coriolanus may raiſe the ſiege, others fearing it, others again ſuſpecting it. But the principal group forms the picturesque part

Andrew Bell, Eſq. in Edinburgh, of the figures of which, as they are engraved under the inſpection of ſo able an anatomiſt as Mr Fyfe, and with the approbation of Dr Monro, we may at leaſt form a favourable opinion; and if well executed, of which there can be but little doubt, they will unqueſtionably be of eſſential ſervice to the painter.

Painter's Balance.

part of the piece. Coriolanus, hastily descending from his tribunal, and hurried on by filial affection, to embrace his mother, stops short through shame, on her crying out to him, Hold? let me first know, if it is a son, or an enemy, I am going to embrace? Thus a painter may impart novelty to the most hackneyed subject, by taking for his guides those authors who possess the happy talent of adding grace and dignity, by their beautiful and sublime descriptions, even to the most common and trifling transactions.

Livy, Dec. ii. lib. 2.

Sect. XIV *Of the Painter's Balance.*

The celebrated De Piles, who by his writings has thrown so much light upon painting, in order to assist young painters in forming a right judgment of those masters who hold the first rank in the profession, and to reduce such judgment to the greater precision, bethought himself of a pictorical balance, by means of which a painter's merit may be weighed with the greatest exactness. This merit he divides into Composition, Design, Colouring, and Expression; and in each of these branches he has assigned to every painter that share to which he thought him intitled, according as he approached more or less the highest degree of excellence and summit of perfection; so that, by summing up the numbers which, standing against each master's name, express his share of merit in each of these branches, we have his total merit or value in the art, and may hence gather what rank one painter holds in regard to another. Several objections, it is true, have been started to this method of calculation, by a famous mathematician of our days, who, among other things, insists, that it is the product of the above numbers multiplied by each other, and not the sum of them, that gives the merit of the artist. But this is not a place to enter into such niceties, nor indeed would the doing of it be of any service to the art. The only thing worth our notice is, whether the original numbers, standing for the painter's merit in the several branches of his art, are such as he is really intitled to, without suffering ourselves to be biassed by any partiality, as De Piles has been, in favour of the prince of the Flemish school; the consequence of which, strange as it may appear, is, that in his balance Raphael and Rubens exactly turn out of the same weight.

See Mairan's remarks, in *Mem. de l'Acad. des Sciences*, 1753.

The idea of the painter's balance is doubtless curious, and therefore deserved to be mentioned; but as the merits of the most eminent painters have been already appreciated under the second section of the historical part of our article, to which we refer, it is needless to be more particular here, or to repeat what has been already treated of at sufficient length.

Sect. XV. *Practical Observations.*

Having thus laid down the principles of the art, and ventured to give the student some directions with regard to his studies, we shall conclude this part of the subject with a few observations relative wholly to practice.

And, 1. The young painter must be careful not to be led astray by the ambition of composing easily, or attaining what is called a *masterly handling* of the chalk or the pencil; a pernicious attempt, by which students are excluded from all power of advancing in real excellence. To this attempt, however, young men have not only the frivolous ambition of being thought masterly, inciting them on the one hand, but also their natural sloth tempting them on the other. They are terrified at the prospect before them, and of the toil required to obtain exactness; whilst the lives of the most eminent painters furnish us with examples of the most unceasing industry. When they conceived a subject, they first made a variety of sketches; then a finished drawing of the whole; after that a more correct drawing of every separate part, heads, hands, feet, and pieces of drapery; they then painted the picture, and after all retouched it from the life. The pictures thus wrought with such care, now appear like the effects of enchantment, and as if some mighty genius had struck them off at a blow.

Practical Observations.

But a student is not always advancing because he is employed; he must apply his strength to that part of the art where the real difficulties lie; to that part which distinguishes it as a liberal art, and not by mistaken industry lose his time in that which is merely ornamental. The students, instead of vying with each other who shall have the readiest hand, should be taught to labour who shall have the purest and most correct outline; instead of striving who shall produce the brightest tint, or endeavouring to give the gloss of stuffs so as to make them appear real, let their ambition be directed to contend, who shall dispose his drapery in the most graceful folds, and give the greatest dignity to the human form.

He who endeavours to copy accurately the figure before him, not only acquires a habit of exactness and precision, but is continually advancing in his knowledge of the human figure; and though he seems to superficial observers to make a slower progress, he will be found at last capable of adding (without running into capricious wildness) that grace and beauty which is necessary to be given to his more finished works, and which cannot be got by the moderns, as it was not acquired by the ancients, but by an attentive and well-directed study of the human form.

2. It is, in the next place, a matter of great importance, that the drawings on which the young artist first exercises his talents be of the most excellent kind. Let the profiles, the hands, and the feet given him to copy, be of the best masters, so as to bring his eye and his hand early acquainted with the most elegant forms and the most beautiful proportions. A painter who has early acquired a fine taste, finds it an easy matter to give dignity to the meanest features, while even the works of a Praxiteles or a Glycon are seen to suffer in the hands of another. A vessel will ever retain the scent which it has first contracted.

3. It would be proper also to make the pupil copy some fine heads from the Greek and Roman medals; not so much for the reason just laid down, as to make him acquainted, if we may use the expression, with those personages which in time he may have occasion to introduce into his pieces, and, above all, to improve him early in the arts of copying from relief. Hence he will learn the rationale of light and shade, and the nature of that chiaro scuro by which it is, properly speaking, that the various forms of things are distinguished.

There is no danger of studying too much the works of

Practical Observations.

of the greatest masters, either in painting or sculpture; but how they may be studied to advantage is an inquiry of great importance. "Some (says Sir Joshua Reynolds), who have never raised their minds to the consideration of the real dignity of the art, and who rate the works of an artist in proportion as they excel or are defective in the mechanical parts, look on theory as something that may enable them to talk, but not to paint better; and, confining themselves entirely to mechanical practice, very assiduously toil in the drudgery of copying, and think they make a rapid progress, while they faithfully exhibit the minutest part of a favourite picture. This appears to me a very tedious, and, I think, a very erroneous method of proceeding. Of every large composition, even of those which are most admired, a great part may be truly said to be common place. This, though it takes up much time in copying, conduces little to improvement. I consider general copying as a delusive kind of industry: the student satisfies himself with the appearance of doing something; he falls into the dangerous habit of imitating without selecting, and of labouring without any determinate object: as it requires no effort of the mind, he sleeps over his work; and those powers of invention and composition which ought particularly to be called out, and put in action, lie torpid, and lose their energy for want of exercise.

"However, as the practice of copying is not entirely to be excluded, since the mechanical practice of painting is learned in some measure by it, let those choice parts only be selected which have recommended the work to notice. If its excellence consists in its general effect, it will be proper to make slight sketches of the machinery and general management of the picture. Those sketches should be kept always by you, for the regulation of your style. Instead of copying the touches of those great masters, copy only their conceptions. Instead of treading in their footsteps, endeavour only to keep the same road. Labour to invent on their general principles and way of thinking. Possess yourself with their spirit. Consider with yourself how a Michael Angelo or a Raphael would have treated this subject, and work yourself into a belief that your picture is to be seen and criticised by them when completed. Even an attempt of this kind will rouse your powers."

The same great master recommends to students to keep their minds fixed on the highest excellencies.—"If you compass them, and compass nothing more, you are still in the first class. We may regret the innumerable beauties which you may want: you may be very imperfect; but still you are an imperfect person of the highest order.

"I inculcate as frequently as I can your forming yourselves upon great principles and great models.—Your time will be much mispent in every other pursuit. Small excellencies should be viewed, not studied; they ought to be viewed, because nothing ought to escape a painter's observation, but for no other reason.

"There is another caution which I wish to give you. Be as select in those whom you endeavour to please, as in those whom you endeavour to imitate. Without the love of fame you can never do any thing excellent; but by an excessive and undistinguishing thirst after it, you will come to have vulgar views; you will degrade your style; and your taste will be entirely corrupted. It is certain that the lower style will be the most popular, as it falls within the compass of ignorance itself, and the vulgar will always be pleased with what is natural in the confined and misunderstood sense of the word."

Genius he considers as an improveable talent, never to be destroyed by the most excessive, if well directed, application, and displaying the elegancies of the art in proportion to the number of ideas which have been carefully collected and digested in the mind.

He cautions painters, therefore, in every stage of their progress, to beware of that false opinion, but too prevalent among artists, of the imaginary power of native genius, and its sufficiency in great works.

This opinion, according to the temper of mind it meets with, almost always produces, either a vain confidence or a sluggish despair, both equally fatal to all proficiency. "Study, therefore, the great works of the great masters for ever. Study, as nearly as you can, in the order, in the manner, on the principles on which they studied. Study nature attentively, but always with those masters in your company: consider them as models which you are to imitate, and at the same time as rivals whom you are to combat."

PART II. Of the Different CLASSES of PAINTING.

SECT. I. *General Enumeration.*

As all the objects in nature are susceptible of imitation by the pencil, the masters of this art have applied themselves to different subjects, each one as his talents, his taste, or inclination may have led him.—From whence have arisen the following classes.

I. *History painting;* which represents the principal events in history sacred and profane, real or fabulous; and to this class belongs *allegorical expression.* These are the most sublime productions of the art; and in which Raphael, Guido, Rubens, Le Brun, &c. have excelled.

II. *Rural history;* or the representation of a country life, of villages and hamlets, and their inhabitants. This is an inferior class; and in which Teniers, Breughel, Watteau, &c. have great reputation, by rendering it at once pleasing and graceful.

III. *Portrait painting;* which is an admirable branch of this art, and has engaged the attention of the greatest masters in all ages, as Apelles, Guido, Vandyke, Rembrandt, Regauds, Pesne, Kneller, La Tour, &c.

IV. *Grotesque histories;* as the nocturnal meetings of witches, sorceries and incantations; the operations of mountebanks, &c. a sort of painting in which the younger Breughel, Teniers, and others, have exercised their talents with success.

V. *Battle*

General Enumeration.

V. *Battle pieces;* by which Huchtemberg, Wouvermans, &c. have rendered themselves famous.

VI. *Landscapes;* a charming species of painting, that has been treated by masters of the greatest genius in every nation.

VII. *Landscapes diversified with waters*, as rivers, lakes, cataracts, &c.; which require a peculiar talent, to express the water sometimes smooth and transparent, and at others foaming and rushing furiously along.

VIII. *Sea pieces;* in which are represented the ocean, harbours, and great rivers; and the vessels, boats, barges, &c. with which they are covered; sometimes in a calm, sometimes with a fresh breeze, and at others in a storm. In this class Backhuysen, Vandervelde, Blome, and many others, have acquired great reputation.

IX. *Night pieces;* which represent all sorts of objects, either as illuminated by torches, by the flames of a conflagration, or by the light of the moon. Schalk, Vanderneer, Vanderpool, &c. have here excelled.

X. *Living Animals:* A more difficult branch of painting than is commonly imagined; and in which Rosa, Carre, Vandervelde, and many others, have succeeded marvellously well.

XI. *Birds of all kinds;* a very laborious species, and which requires extreme patience minutely to express the infinite variety and delicacy of their plumage.

XII. *Culinary pieces;* which represent all sorts of provisions, and animals without life, &c. A species much inferior to the rest, in which nature never appears to advantage, and which requires only a servile imitation of objects that are but little pleasing. The painting of fishes is naturally referred to this class.

XIII. *Fruit pieces;* of every kind, imitated from nature.

XIV. *Flower pieces;* a charming class of painting, where Art in the hands of Huyzum, P. Segerts, Merian, &c. becomes the rival of Nature. *Plants* and *insects* are usually referred to the painters of flowers, who with them ornament their works.

XV. *Pieces of architecture;* a kind of painting in which the Italians excel all others. Under this class may be comprehended the representations of ruins, seaports, streets, and public places; such are seen in the works of Caneletti, and other able masters.

XVI. *Instruments of music, pieces of furniture*, and other inanimate objects; a trifling species, and in which able painters only accidentally employ their talents.

XVII. *Imitations of bas-reliefs;* a very pleasing kind of painting, and which may be carried by an able hand to a high degree of excellence.

XVIII. *Hunting pieces:* these also require a peculiar talent, as they unite the painting of men, horses, dogs, and game, to that of landscapes,

It will not be expected that we should here give the rules that the painter is to observe in handling each particular subject. What has been said on historical painting (Part I. *) may throw some light on the rest, and the particular rules must be learned from the study of the art itself. Good masters, academies of reputation, and a rational practice, are the sources from whence the young painter must derive the detail of his art. We shall however insert some rules and observations relative to *Landscape* and *Portrait;* these, with *History painting* (already pretty fully treated), forming the principal branches of the art.

* In the sections of *Invention* and *Disposition*.

Landscapes.

Sect. II. *Of Landscapes.*

Landscape painting includes every object that the country presents: and it is distinguished into the *heroic*, and the *pastoral* or *rural;* of which indeed all other styles are but mixtures.

De Piles on Painting.

The *heroic style* is a composition of objects, which in their kinds draw both from art and nature every thing that is great and extraordinary in either. The situations are perfectly agreeable and surprising. The only buildings are temples, pyramids, ancient places of burial, altars consecrated to the divinities, pleasure houses of regular architecture; and if nature appear not there as we every day casually see her, she is at least represented as we think she ought to be. This style is an agreeable illusion, and a sort of enchantment, when handled by a man of fine genius and a good understanding, as Poussin was, who has so happily expressed it. But if, in the course of this style, the painter has not talent enough to maintain the sublime, he is often in danger of falling into the childish manner.

The *rural style* is a representation of countries, rather abandoned to the caprice of nature, than cultivated: we there see nature simple, without ornament, and without artifice; but with all those graces wherewith she adorns herself much more when left to herself than when constrained by art.

In this style, situations bear all sorts of varieties: sometimes they are very extensive and open, to contain the flocks of the shepherds; at others very wild, for the retreat of solitary persons, and a cover for wild beasts.

It rarely happens that a painter has a genius extensive enough to embrace all the parts of painting: there is commonly some one part that pre-engages our choice, and so fills our mind, that we forget the pains that are due to the other parts; and we seldom fail to see, that those whose inclination leads them to the heroic style, think they have done all, when they have introduced into their compositions such noble objects as will raise the imagination, without ever giving themselves the trouble to study the effects of good colouring. Those, on the other hand, who practise the pastoral, apply closely to colouring, in order to represent truth more lively. Both these styles have their sectaries and partisans. Those who follow the heroic, supply by their imagination what it wants of truth, and they look no farther.

As a counterbalance to heroic landscape, it would be proper to put into the pastoral, besides a great character of truth, some affecting, extraordinary, but probable effect of nature, as was Titian's custom.

There is an infinity of pieces wherein both these styles happily meet; and which of the two has the ascendant, will appear from what we have been just observing of their respective properties. The chief parts of landscapes are, their openings or situations, accidents, skies and clouds, offskips and mountains, verdure or turfing, rocks, grounds, or lands, terraces, fabrics, waters, fore-grounds, plants, figures, and trees; of all which in their places.

Of

Of Openings or Situations. The word *site*, or situation, signifies the "view, prospect, or opening of a country." It is derived from the Italian word *sito;* and our painters have brought it into use, either because they were used to it in Italy, or because, as we think, they found it to be very expressive.

Situations ought to be well put together; and so disengaged in their make, that the conjunction of grounds may not seem to be obstructed, though we should see but a part of them.

Situations are various, and represented according to the country the painter is thinking of: as either open or close, mountainous or watery, tilled and inhabited, or wild and lonely; or, in fine, variegated by a prudent mixture of some of these. But if the painter be obliged to imitate nature in a flat and regular country, he must make it agreeable by a good disposition of the *claro-obscuro*, and such pleasing colouring as may make one soil unite with another.

It is certain, that extraordinary situations are very pleasing, and cheer the imagination by the novelty and beauty of their makes, even when the local colouring is but moderately performed: because, at worst, such pictures are only looked on as unfinished, and wanting to be completed by some skilful hand in colouring; whereas common situations and objects require good colouring and absolute finishing, in order to please. It was only by these properties that Claude Lorrain has made amends for his insipid choice in most of his situations. But in whatever manner that part be executed, one of the best ways to make it valuable, and even to multiply and vary it without altering its form, is properly to imagine some ingenious accident in it.

Of Accidents. An accident in painting is an obstruction of the sun's light by the interposition of clouds, in such manner, that some parts of the earth shall be in light and others in shade, which, according to the motion of the clouds, succeed each other, and produce such wonderful effects and changes of the *claro-obscuro*, as seem to create so many new situations. This is daily observed in nature. And as this newness of situations is grounded only on the shapes of the clouds, and their motions, which are very inconstant and unequal, it follows, that these accidents are arbitrary; and a painter of genius may dispose them to his own advantage when he thinks fit to use them: For he is not absolutely obliged to do it; and there have been some able landscape painters who have never practised it, either through fear or custom, as Claude Lorrain and some others.

Of the Sky and Clouds. The sky, in painters terms, is the ethereal part over our heads; but more particularly the air in which we breathe, and that where clouds and storms are engendered. Its colour is blue, growing clearer as it approaches the earth, because of the interposition of vapours arising between the eye and the horizon; which, being penetrated by the light, communicates it to objects in a greater or lesser degree, as they are more or less remote.

But we must observe, that this light being either yellow or reddish in the evening, at sunset, these same objects partake not only of the light, but of the colour: thus the yellow light mixing with the blue, which is the natural colour of the sky, alters it, and gives it a tint more or less greenish, as the yellowness of the light is more or less deep.

This observation is general and infallible: but there is an infinity of particular ones, which the painter must make upon the natural, with his pencil in his hand, when occasion offers; for there are very fine and singular effects appearing in the sky, which it is difficult to make one conceive by physical reasons. Who can tell, for example, why we see, in the bright part of some clouds, a fine red, when the source of the light which plays upon them is a most lively and distinguishing yellow? Who can account for the different reds seen in different clouds, at the very moment that these reds receive the light but in one place? for these colours and surprising appearances seem to have no relative to the rainbow, a phenomenon for which the philosopher pretends to give solid reasons.

These effects are all seen in the evening when the weather is inclining to change, either before a storm, or after it, when it is not quite gone, but has left some remains of it to draw our attention.

The property of clouds is to be thin and airy, both in shape and colour: their shapes, though infinite, must be studied and chosen after nature, at such times as they appear fine. To make them look thin, we ought to make their grounds unite thinly with them, especially near their extremities, as if they were transparent: And if we would have them thick, their reflections must be so managed, as, without destroying their thinness, they may seem to wind and unite, if necessary, with the clouds that are next to them. Little clouds often discover a little manner, and seldom have a good effect, unless when, being near each other, they seem altogether to make but one object.

In short, the character of the sky is to be luminous; and, as it is even the source of light, every thing that is upon the earth must yield to it in brightness: If, however, there is any thing that comes near it in light, it must be waters, and polished bodies which are susceptible of luminous reflections.

But whilst the painter makes the sky luminous, he must not represent it always shining throughout.

On the contrary, he must contrive his light so, that the greatest part of it may fall only upon one place: and, to make it more apparent, he must take as much care as possible to put it in opposition to some terrestrial object, that may render it more lively by its dark colour; as a tree, tower, or some other building that is a little high.

This principal light might also be heightened, by a certain disposition of clouds having a supposed light, or a light ingeniously inclosed between clouds, whose sweet obscurity spreads itself by little and little on all hands. We have a great many examples of this in the Flemish school, which best understood landscape; as Paul Bril, Brugel, Saveri: And the Sadelers and Merian's prints give a clear idea of it, and wonderfully awaken the genius of those who have the principles of the *claro-scuro*.

Of Offskips and Mountains. Offskips have a near affinity with the sky; it is the sky which determines either the force or faintness of them. They are darkest when the sky is most loaded, and brightest when it is most clear. They sometimes intermix their shapes and lights;

Landscapes.

lights; and there are times, and countries, where the clouds pass between the mountains, whose tops rise and appear above them. Mountains that are high, and covered with snow, are very proper to produce extraordinary effects in the offskip, which are advantageous to the painter, and pleasing to the spectator.

The disposition of offskips is arbitrary; let them only agree with the whole together of the picture, and the nature of the country we would represent. They are usually blue, because of the interposition of air between them and the eye: but they lose this colour by degrees, as they come nearer the eye, and so take that which is natural to the objects.

In distancing mountains, we must observe to join them insensibly by the roundings off, which the reflections make probable; and must, among other things, avoid a certain edginess in their extremities, which makes them appear in slices, as if cut with scissars, and stuck upon the cloth.

We must further observe, that the air at the feet of mountains, being charged with vapours, is more susceptible of light than at their tops. In this case we suppose the main light to be set reasonably high, and to enlighten the mountains equally, or that the clouds deprive them of the light of the sun. But if we suppose the main light to be very low, and to strike the mountains, then their tops will be strongly enlightened, as well as every thing else in the same degree of light.

Though the forms of things diminish in bigness, and colours lose their strength, in proportion as they recede from the first plan of the picture, to the most remote offskip, as we observe in nature and common practice; yet this does not exclude the use of the accidents. These contribute greatly to the wonderful in landscape, when they are properly introduced, and when the artist has a just idea of their good effects.

Of Verdure, or *Turfing*. By turfing is meant the greenness with which the herbs colour the ground: This is done several ways; and the diversity proceeds not only from the nature of plants, which, for the most part, have their particular verdures, but also from the change of seasons, and the colour of the earth, when the herbs are but thin sown. By this variety, a painter may choose or unite, in the same tract of land, several sorts of greens intermixed and blended together, which are often of great service to those who know how to use them; because this diversity of greens, as it is often found in nature, gives a character of truth to those parts, where it is properly used. There is a wonderful example of this part of landscape, in the view of Mechlin, by Rubens.

Of Rocks. Though rocks have all sorts of shapes, and participate of all colours, yet there are in their diversity certain characters which cannot be well expressed without having recourse to nature. Some are in banks, and set off with beds of shrubs; others in huge blocks, either projecting or falling back; others consist of large broken parts, contiguous to each other; and others, in short, of an enormous size, all in one stone, either naturally, as free-stone, or else through the injuries of time, which in the course of many ages has worn away their marks of separation. But, whatever their form be, they are usually set out with clefts, breaks, hollows, bushes, moss, and the stains of time; and these particulars, well managed, create a certain idea of truth.

Rocks are of themselves gloomy, and only proper for solitudes: but where accompanied with brushes, they inspire a fresh air; and when they have waters, either proceeding from, or washing them, they give an infinite pleasure, and seem to have a soul which animates them, and makes them sociable.

Of Grounds or *Lands*. A ground or land, in painters terms, is a certain distinct piece of land, which is neither too woody nor hilly. Grounds contribute, more than any thing, to the gradation and distancing of landscape; because they follow one another, either in shape, or in the *claro-obscuro*, or in their variety of colouring, or by some insensible conjunction of one with another.

Multiplicity of grounds, though it be often contrary to grand manner, does not quite destroy it; for besides the extent of country which it exhibits, it is susceptible of the accidents we have mentioned, and which, with good management, have a fine effect.

There is one nicety to be observed in grounds, which is, that in order to characterize them well, care must be taken, that the trees in them have a different verdure and different colours from those grounds; though this difference, withal, must not be too apparent.

Of Terraces. A terrace, in painting, is a piece of ground, either quite naked or having very little herbage, like great roads and places often frequented. They are of use chiefly in the foregrounds of a picture, where they ought to be very spacious and open, and accompanied, if we think fit, with some accidental verdure, and also with some stones, which, if placed with judgement, give a terrace a greater air of probability.

Of Buildings. Painters mean by buildings any structures they generally represent, but chiefly such as are of a regular architecture, or at least are most conspicuous. Thus building is not so proper a name for the houses of country-people, or the cottages of shepherds, which are introduced into the *rural* taste, as for regular and showy edifices, which are always brought into the *heroic*.

Buildings in general are a great ornament in landscapes, even when they are Gothic, or appear partly inhabited and partly ruinous: they raise the imagination by the use they are thought to be designed for; as appears from ancient towers, which seem to have been the habitations of fairies, and are now retreats for shepherds and owls.

Poussin has very elegantly handled the Roman manner of architecture in his works, as Bourdon has done the Gothic; which, however Gothic, fails not to give a sublime air to his landscapes. Little Bernard has introduced into his sacred history what may be called a Babylonian manner; which, extraordinary as it is, has its grandeur and magnificence. Nor ought such pieces of architecture to be quite rejected: they raise the imagination; and perhaps would succeed in the heroic style, if they were placed among half-distant objects, and if we knew how to use them properly.

Of Waters. Much of the spirit of landscape is owing to the waters which are introduced in it. They appear in divers manners; sometimes impetuous, as when a storm makes them overflow their banks; at other times rebounding, as by the fall of a rock; at other times, through unusual pressure, gushing out and dividing into an infinity of silver streams, whose motion and murmuring agreeably deceive both the eye and ear; at other times calm and purling in a sandy bed; at other times so still and standing, as to become a faithful looking-glass, which doubles

doubles all the objects that are opposite to it; and in this state they have more life than in the most violent agitation. Consult Bourdon's works, or at least his prints, on this subject: he is one of those who have treated of waters with the greatest spirit and best genius.

Waters are not proper for every situation: but to express them well, the artist ought to be perfect master of the exactness of watery reflections; because they only make painted water appear as real: for practice alone, without exactness, destroys the effect, and abates the pleasure of the eye. The rule for these reflections is very easy, and therefore the painter is the less pardonable for neglecting it.

But it must be observed, that though water be as a looking-glass, yet it does not faithfully represent objects but when it is still; for if it be in any motion, either in a natural course, or by the driving of the wind, its surface becoming uneven, receives on its surges such lights and shades as, mixing with the appearance of the objects, confound both their shapes and colours.

Of the Foreground of a Picture. As it is the part of the foreground to usher the eye into the piece, great care must be taken that the eye meet with good reception; sometimes by the opening of a fine terrace, whose design and workmanship may be equally curious; sometimes by a variety of well distinguished plants, and those sometimes flowered; and at other times, by figures in a lively taste, or other objects, either admirable for their novelty or introduced as by chance.

In a word, the artist cannot too much study his foreground objects, since they attract the eye, impress the first character of truth, and greatly contribute to make the artifice of a picture successful, and to anticipate our esteem for the whole work.

Of Plants. Plants are not always necessary in foregrounds, because, as we have observed, there are several ways of making those grounds agreeable. But if we resolve to draw plants there, we ought to paint them exactly after the life; or at least, among such as we paint practically, there ought to be some more finished than the rest, and whose kinds may be distinguished by the difference of design and colouring, to the end that, by a probable supposition, they may give the others a character of truth. What has been said here of plants may be applied to the branches and barks of trees.

Of Figures. In composing landscape, the artist may have intended to give it a character agreeable to the subject he has chosen, and which his figures ought to represent. He may also, and it commonly happens, have only thought of his figures after finishing his landscape. The truth is, the figures in most landscapes are made rather to accompany than to suit them.

It is true, there are landscapes so disposed and situated, as to require only passing figures; which several good masters, each in his style, have introduced, as Poussin in the heroic, and Fouquier in the rural, with all probability and grace.' It is true also, that resting figures have been made to appear inwardly active. And these two different ways of treating figures are not to be blamed, because they act equally, though in a different manner. It is rather inaction that ought to be blamed in figures; for in this condition, which robs them of all connection with the landscape, they appear to be pasted on. But without obstructing the painter's liberty in this respect, undoubtedly the best way to make figures valuable is, to make them so to agree with the character of the landscape, that it may seem to have been made purely for the figures. We would not have them either insipid or indifferent, but to represent some little subject to awaken the spectator's attention, or else to give the picture a name of distinction among the curious.

Great care must be taken to proportion the size of the figures to the bigness of the trees, and other objects of the landscape. If they be too large, the picture will discover a little manner; and if too small, they will have the air of pigmies; which will destroy the worth of them, and make the landscape look enormous. There is, however, a greater inconvenience in making figures too large than too small; because the latter at least gives an air of greatness to all the rest. But as landscape figures are generally small, they must be touched with spirit, and such lively figures as will attract, and yet preserve probability and a general union. The artist must, in fine, remember, that as the figures chiefly give life to a landscape, they must be dispersed as conveniently as possible.

Of Trees. The beauty of trees is perhaps one of the greatest ornaments of landscape; on account of the variety of their kinds, and their freshness, but chiefly their lightness, which makes them seem, as being exposed to the air, to be always in motion.

Though diversity be pleasing in all the objects of landscape, it is chiefly in trees that it shows its greatest beauty. Landscape considers both their kinds and their forms. Their kinds require the painter's particular study and attention, in order to distinguish them from each other; for we must be able at first sight to discover which are oaks, elms, firs, sycamores, poplars, willows, pines, and other such trees, which, by a specific colour, or touching, are distinguishable from all other kinds. This study is too large to be acquired in all its extent; and, indeed, few painters have attained such a competent exactness in it as their art requires. But it is evident, that those who come nearest to perfection in it, will make their works infinitely pleasing, and gain a great name.

Besides the variety which is found in each kind of tree, there is in all trees a general variety. This is observed in the different manners in which their branches are disposed by a sport of nature; which takes delight in making some very vigorous and thick, others more dry and thin; some more green, others more red or yellow. The excellence of practice lies in the mixture of these varieties: but if the artist can distinguish the sorts but indifferently, he ought at least to vary their makes and colours; because repetition in landscape is as tiresome to the eye, as monotony in discourse is to the ear.

The variety of their makes is so great, that the painter would be inexcusable not to put it in practice upon occasion, especially when he finds it necessary to awaken the spectator's attention; for, among trees, we discover the young and the old, the open and close, tapering and squat, bending upwards and downwards, stooping and shooting: in short, the variety is rather to be conceived than expressed. For instance, the character of young trees is, to have long slender branches, few in number, but

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but well set out; boughs well divided, and the foliage vigorous and well shaped: whereas, in old trees, the branches are short, stocky, thick, and numerous; the tufts blunt, and the foliage unequal and ill shaped; but a little observation and genius will make us perfectly sensible of these particulars.

In the various makes of trees, there must also be a distribution of branches, that has a just relation to, and probable connection, with, the boughs or tufts, so as mutually to assist each other in giving the tree an appearance of thickness and of truth. But whatever their natures or manners of branching be, let it be remembered, that the handling must be lively and thin, in order to preserve the spirit of their characters.

Trees likewise vary in their barks, which are commonly gray; but this gray, which in thick air, and low and marshy places, looks blackish, appears lighter in a clear air: and it often happens, in dry places, that the bark gathers a thin moss, which makes it look quite yellow; so that, to make the bark of a tree apparent, the painter may suppose it to be light upon a dark ground, and dark on a light one.

The observation of the different barks merits a particular attention; for it will appear, that, in hard woods, age chaps them, and thereby gives them a sort of embroidery; and that, in proportion as they grow old, these chaps grow more deep. And other accidents in barks may arise either from moisture, or dryness, or green mosses, or white stains of several trees.

The barks of white woods will also afford much matter for practice, if their diversity be duly studied; and this consideration leads us to say something of the study of landscape.

Of the Study of Landscape. The study of landscape may be considered either with respect to beginners, or those who have made some advances in it.

Beginners will find, in practice, that the chief trouble of landscape lies in handling trees; and it is not only in practice, but also in speculation, that trees are the most difficult part of landscape, as they are its greatest ornament. But it is only proposed here, to give beginners an idea of trees in general, and to show them how to express them well. It would be needless to point out to them the common effects of trees and plants, because they are obvious to every one; yet there are some things, which, though not unknown, deserve our reflection. We know, for instance, that all trees require air, some more, some less, as the chief cause of their vegetation and production; and for this reason, all trees (except the cypress, and some others of the same kind) separate in their growth from one another, and from other strange bodies as much as possible, and their branches and foliage do the same: wherefore, to give them that air and thinness, which is their principal character, the branches, boughs, and foliage, must appear to fly from each other to proceed from opposite parts, and be well divided. And all this without order; as if chance aided nature in the fanciful diversity. But to say particularly how these trunks, branches, and foliages, ought to be distributed, would be needless, and only a description of the works of great masters: a little reflection on nature will be of more service than all that can be said on this head. By great masters, we mean such as have published prints; for those will give better ideas to young copyists than even the paintings themselvess.

Among the many great masters of all schools, De Piles prefers Titian's wooden prints, where the trees are well shaped; and those which Cornelius Cort and Agostino Caracci have engraved. And he asserts, that beginners can do no better than contract, above all things, an habit of imitating the touches of these great masters; and of considering at the same time the perspective of the branches and foliages, and observing how they appear, either when rising and seen from below, or when sinking and seen from above, or when fronting and viewed from a point, or when they appear in profile; and, in a word, when set in the various views in which nature presents them, without altering their characters.

After having studied and copied with the pen or crayon, first the prints, and then the designs of Titian and Caracci, the student should imitate with the pencil those touches which they have most distinctly specified, if their paintings can be procured; but since they are scarce, others should be got which have a good character for their touching; as those of Foquier, who is a most excellent model: Paul Bril, Breugel, and Bourdon, are also very good; their touching is neat, lively, and thin.

After having duly weighed the nature of trees, their spread and order, and the disposition of their branches, the artist must get a lively idea of them, in order to keep up the spirit of them throughout, either by making them apparent and distinct in the fore-grounds, or obscure and confused in proportion to their distance.

After having thus gained some knowledge in good manner, it will next be proper to study after nature, and to choose and rectify it according to the idea which the aforesaid great masters had of it. As to perfection, it can only be expected from long practice and perseverance. On the whole, it is proper for those who have an inclination for landscape, above all things to take the proper methods for beginning it well.

As for those who have made some advances in this part of painting, it is proper they should collect the necessary materials for their further improvement, and study those objects at least which they shall have most frequent occasion to represent.

Painters usually comprise, under the word *study*, any thing whatever which they either design or paint separately after the life; whether figures, heads, feet, hands, draperies, animals, mountains, trees, plants, flowers, fruits, or whatever may confirm them in the just imitation of nature: the drawing of these things is what they call *study;* whether they be for instruction in design, or only to assure them of the truth, and to perfect their work. In fact, this word *study* is the more properly used by painters as in the diversity of nature they are daily making new discoveries, and confirming themselves in what they already know.

As the landscape-painter need only study such objects as are to be met with in the country, we would recommend to him some order, that his drawings may be always at hand when he wants them. For instance, he should copy after nature, on separate papers, the different effects of trees in general, and the different effects of each kind in particular, with their trunks, foliage, and colours. He should also take the same method with some sorts of plants, because their variety is a great ornament to terraces on fore-grounds. He ought likewise to study the effects of the sky in the several times of the day and

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and seasons of the year, in the various dispositions of clouds, both in serene, thundering, and stormy weather; the offskip, the several sorts of rocks, waters, and other principal objects.

These drawings, which may be made at different times, should be collected together; and all that relate to one matter be put into a book, to which the artist may have recourse at any time for what he wants.

Now, if the fine effects of nature, whether in shape or colour, whether for an entire picture or a part of one, be the artist's study; and if the difficulty lies in choosing those effects well, he must for this purpose be born with good sense, good taste, and a fine genius; and this genius must be cultivated by the observations which ought to be made on the works of the best masters, how they choose nature, and how, while they corrected her, according to their art, they preserved her character. With these advantages, derived from nature, and perfected by art, the painter cannot fail to make a good choice; and, by distinguishing between the good and the bad, must needs find great instruction even from the most common things.

To improve themselves in this kind of studies, painters have taken several methods.

There are some artists who have designed after nature, and in the open fields; and have there quite finished those parts which they had chosen, but without adding any colour to them.

Others have drawn, in oil colours, in a middle tint, on strong paper; and found this method convenient, because, the colours sinking, they could put colour on colour, though different from each other. For this purpose they took with them a flat box, which commodiously held their pallet, pencils, oil, and colours. This method, which indeed requires several implements, is doubtless the best for drawing nature more particularly, and with greater exactness, especially if, after the work be dry and varnished, the artist return to the place where he drew, and retouch the principal things after nature.

Others have only drawn the outlines of objects, and slightly washed them in colours near the life, for the ease of their memory. Others have attentively observed such parts as they had a mind to retain, and contented themselves with committing them to their memory, which upon occasion, gave them a faithful account of them. Others have made drawings in pastil and wash together. Others, with more curiosity and patience, have gone several times to the places which were to their taste: the first time they only made choice of the parts, and drew them correctly; and the other times were spent in observing the variety of colouring, and its alterations through change of light.

Now these several methods are very good, and each may be practised as best suits the student and his temper: but they require the necessaries of painting, as colours, pencils, pastils, and leisure. Nature, however, at certain times, presents extraordinary but transient beauties, and such as can be of no service to the artist who has not as much time as is necessary to imitate what he admires. The best way, perhaps, to make advantage of such momentary occasions, is this:

The painter being provided with a quire of paper, and a black-lead pencil, let him quickly, but slightly, design what he sees extraordinary; and to remember the colouring, let him mark the principal parts with characters, which he may explain at the bottom of the paper, as far as is necessary for himself to understand them: A cloud, for instance, may be marked A, another cloud B, a light C, a mountain D, a terrace E, and so on. And having repeated these letters at the bottom of the paper, let him write against each that it is of such or such a colour; or, for greater brevity, only *blue*, *red*, *violet*, *gray*, &c. or any other shorter abbreviation. After this, he must go to painting as soon as possible; otherwise most of what he has observed will, in a little time, slip out of his memory. This method is the more useful, as it not only prevents our losing an infinity of sudden and transitory beauties, but also helps, by means of the aforesaid marks and characters, to perfect the other methods we have mentioned.

If it be asked, Which is the properest time for these studies? the answer is, That nature should be studied at all times, because she is to be represented at all seasons; but autumn yields the most plentiful harvest for her fine effects: the mildness of that season, the beauty of the sky, the richness of the earth, and the variety of objects, are powerful inducements with the painter to make the proper inquiries for improving his genius and perfecting his art.

But as we cannot see or observe every thing, it is very commendable to make use of other men's studies, and to look upon them as if they were our own. Raphael sent some young men into Greece to design such things as he thought would be of service to him, and accordingly made use of them to as good purpose as if he himself had designed them on the spot: for this, Raphael is so far from deserving censure, that he ought, on the contrary, to be commended; as an example, that painters ought to leave no way untried for improving in their professions. The landscape painter may, accordingly, make use of the works of all those who have excelled in any kind, in order to acquire a good manner; like the bees which gather their variety of honey from different flowers.

General Remarks on Landscapes. As the general rules of painting are the basis of all the several kinds of it, we must refer the landscape painter to them, or rather suppose him to be well acquainted with them. We shall here only make some general remarks on this kind of painting.

I. Landscape supposes the knowledge and practice of the principal rules in *perspective*, in order to maintain probability.

II. The nigher the leaves of trees are to the earth, the larger they are, and the greener; as being aptest to receive, in abundance, the sap which nourishes them: and the upper branches begin first to take the redness or yellowness which colours them in autumn. But it is otherwise in plants; for their stocks renew all the year round, and their leaves succeed one another at a considerable distance of time, insomuch that nature, employed in producing new leaves to adorn the stock as it rises, does by degrees desert the under ones; which, having first performed their office, are the first that die: but this effect is more visible in some than in others.

III. The under parts of all leaves are of a brighter green than the upper, and almost always incline to the silverish;

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silverish; and those which are wind-shaken are known from others by that colour: but if we view them from beneath, when penetrated by the sun's rays, they discover such a fine and lively green as is far beyond all comparison.

IV. There are five principal things which give spirit to landscape, viz. figures, animals, waters, wind-shaken trees, and thinness of pencilling; to which add smoke, when there is occasion to introduce it.

V. When one colour predominates throughout a landscape, as one green in spring, or one red in autumn, the piece will look either as of one colour, or else as unfinished. We have seen many of Bourdon's landscapes, which, by handling the corn one way throughout, have lost much of their beauty, though the situations and waters were very pleasant. The ingenious painter must endeavour to correct, and, as they say, redeem, the harsh unsightly colouring of winter and spring by means of figures, waters, and buildings; for summer and autumn subjects are of themselves capable of great variety.

VI. Titian and Carrache are the best models for inspiring good taste, and leading the painter into a good track, with regard to forms and colours. He must use all his efforts, to gain a just idea of the principles which those great men have left us in their works; and to have his imagination filled with them, if he would advance by degrees towards that perfection which the artist should have always in view.

VII. The landscapes of these two masters tea h us a great many things, of which discourse can give us no exact idea, nor any general principle. Which way, for example, can the measures of trees in general be determined, as we determine those of the human body? The tree has no settled proportions; most of its beauty lies in the contrast of its branches, an unequal distribution of boughs, and, in short, a kind of whimsical variety which nature delights in, and of which the painter becomes a judge when he has thoroughly relished the works of the two masters aforesaid. But we must say, in Titian's praise, that the path he struck out is the surest; because he has exactly imitated nature in its variety with an exquisite taste, and fine colouring: whereas Carrache, though an able artist, has not, more than others, been free from manner in his landscapes.

VIII. One of the greatest perfections of landscape, in the variety it represents, is a faithful imitation of each particular character: as its greatest fault is a licentious practice, which brings us to do things by rote.

IX. Among those things which are painted practically, we ought to intermix some done after nature, to induce the spectator to believe that all are so.

X. As there are styles of thought, so there are also styles of execution. We have handled the two relating to thought, viz. the heroic and pastoral; and find that there are two also with regard to execution, viz. the firm style, and the polished; these two concern the pencil, and the more or less ingenious way of conducting it. The firm style gives life to work, and excuse for bad choice; and the polished finishes and brightens every thing; it leaves no employment for the spectator's imagination, which pleases itself in discovering and finishing things which it ascribes to the artist, though in fact they proceed only from itself. The polished style degenerates into the soft and dull, if not supported by a good opening or situation; but when those two characters meet, the picture is fine.

Portraiture.

Sect. III. *Of Portraiture.*

If painting be an imitation of nature, it is doubly so in a portrait; which not only represents a man in general, but such a one as may be distinguished from all others. And as the greatest perfection of a portrait is extreme likeness, so the greatest of its faults is to resemble a person for whom it was not made; since there are not in the world two persons quite like one another. But before we proceed to the particulars which let us into the knowledge of this imitation, it is necessary, for shortening this part of our subject, to attend to some general propositions.

I. Imitation is the essence of painting: and good choice is to this essence what the virtues are to a man; they raise the value of it. For this reason, it is extremely the painter's interest to choose none but good heads, or favourable moments for drawing them, and such positions as may supply the want of a fine natural.

II. There are views of the natural more or less advantageous; all depends upon turning it well, and taking it in the favourable moment.

III. There is not a single person in the world who has not a peculiar character both in body and face.

IV. Simple and genuine nature is more proper for imitation; and is a better choice than nature much formed, and embellished too artificially.

V. To adorn nature too much is doing it a violence; and the action which attends it can never be free when its ornaments are not easy. In short, in proportion as we adorn nature, we make it degenerate from itself, and bring it down to art.

VI. Some means are more advantageous than others to come at the same end.

VII. We must not only imitate what we do see in nature, but also what we may possibly see that is advantageous in art.

VIII. Things are valuable by comparison; and it is only by this we are enabled to make a right judgment of them.

IX. Painters easily accustom themselves to their own tints, and the manner of their masters: and after this habit is rooted in them, they view nature not as she really is, but as they are used to paint her.

X. It is very difficult to make a picture, the figures of which are as big as the life, to have its effects near as at a distance. A learned picture pleases the ignorant only when it is at some distance; but judges will admire its artifice near, and its effect at a distance.

XI. Knowledge makes work pleasant and easy. The traveller who knows his road, comes to his journey's end with more speed and certainty than he who inquires and gropes it out.

XII. It is proper, before we begin a work, to meditate upon it, and to make a nice coloured sketch of it, for our own satisfaction, and a help to the memory.

We cannot too much reflect on these propositions; and it

Portraiture. it is necessary to be well acquainted with them, that they may present themselves to our mind, of their own accord, without our being at the trouble to recal them to our memory when we are at work.

There are four things necessary to make a portrait perfect; *air*, *colouring*, *attitude*, and *dress*.

Of Air. The air respects the lines of the face, the head attire, and the size.

The lines of the face depend upon exactness of draught, and agreement of the parts; which altogether must represent the physiognomy of the person painted in such a manner, that the picture of his body may seem to be also that of his mind.

It is not exactness of design in portraits that gives spirit and true air, so much as the agreement of the parts at the very moment when the disposition and temperament of the sitter are to be hit off. We see several portraits which, though correctly designed, have a cold, languishing, and stupid air; whilst others, less correct in design, strike us, however, at first sight with the sitter's character.

Few painters have been careful enough to put the parts well together: Sometimes the mouth is smiling, and the eyes are sad: at other times, the eyes are cheerful, and the cheeks lank: by which means their work has a false air, and looks unnatural. We ought therefore to remember, that, when the sitter puts on a smiling air, the eyes close, the corners of the mouth draw up towards the nostrils, the cheeks swell, and the eyebrows widen: but in a melancholy air, these parts have a contrary effect.

The eyebrows, being raised, give a grave and noble air; but if arched, an air of astonishment.

Of all the parts of the face, that which contributes most to likeness is the nose; it is therefore of great moment to set and draw it well.

Though the hair of the head seems to be part of the dress which is capable of various forms without altering the air of the face; yet the head attire which one has been most accustomed to creates such a likeness, that we scarce know a familiar acquaintance on his putting on a periwig somewhat different from that which he used to wear. It is necessary therefore, as far as possible, to take the air of the head ornament, and make it accompany and set off that of the face, if there be no reason to the contrary.

As to the stature, it contributes so much to likeness, that we very often know people without seeing their face: It is therefore extremely proper to draw the size after the sitter himself, and in such an attitude as we think fit; which was Vandyke's method. Here let us remark, that, in sitting, the person appears to be of a less free make, through the heaving of his shoulders; wherefore, to adjust his size, it is proper to make him stand for a small time, swaying in the posture we would give him, and then make our observation. But here occurs a difficulty, which we shall endeavour to examine: "Whether it is proper, in portraiture, to correct the defects of nature?"

Likeness being the essence of portraiture, it would seem that we ought to imitate defects as well as beauties, since by this means the imitation will be more complete: It would be even hard to prove the contrary to one who would undertake the defence of this position. But ladies and gentlemen do not much approve of those painters who entertain such sentiments, and put them in practice. It is certain that some complaisance in this respect is due to them; and there is little doubt but their pictures may be made to resemble, without displeasing them; for the effectual likeness is a just agreement of the parts that are painted with those of nature; so that we may be at no loss to know the air of the face, and the temper of the person, whose picture is before us. All deformities, therefore, when the air and temper may be discovered without them, ought to be either corrected or omitted in women's and young men's portraits. A nose somewhat awry may be helped, or a shrivelled neck or high shoulders adapted to a good air, without going from one extreme to another. But this must be done with great discretion: for, by endeavouring to correct nature too much, we insensibly fall into a method of giving a general air to all our portraits; just as, by confining ourselves too much to the defects and littleness of nature, we are in danger of falling into the low and tasteless manner.

But in the faces of heroes and men of rank, distinguished either by dignities, virtues, or great qualities, we cannot be too exact, whether the parts be beautiful or not: for portraits of such persons are to be standing monuments to posterity; in which case, every thing in a picture is precious that is faithful. But after whatever manner the painter acquits himself in this point, let him never forget good air nor grace; and that there are, in the natural, advantageous moments for hitting them off.

Colouring. *Of Colouring*. Colouring, in portraiture, is an effusion of nature, discovering the true tempers of persons; and the temper being essential to likeness, it ought to be handled as exactly as the design. This part is the more valuable, as it is rare and difficult to hit. A great many painters have come to a likeness by strokes and outlines; but certainly they are few who have shown in colours the tempers of persons.

Two points are necessary in painting; exactness of tints, and the art of setting them off. The former is acquired by practice, in examining and comparing the colours we see in life with those by which we would imitate it: and the art of those tints consists in knowing what one colour will produce when set by another, and in making good what either distance or time may abate of the glow and freshness of the colours.

A painter who does nothing more than what he sees, will never arrive at a perfect imitation; for though his work may seem, on the easel, to be good to him, it may not appear so to others, and perhaps even to himself, at a distance. A tint which, near, appears disjoined, and of one colour, may look of another at a distance, and be confounded in the mass it belongs to. If you would have your work, therefore, to produce a good effect in the place where it is to hang, both the colours and lights must be a little loaded; but learnedly, and with discretion. In this point consult Titian, Rubens, Vandyke, and Rembrandt's method; for indeed their art is wonderful.

The tints usually require three times of observation. The first is at the person's first sitting down, when he has more spirit and colour than ordinary; and this is to be noted in the first hour of his sitting. The second is when, being composed, his look is as usual; which is to be observed in the second hour. And the third is when, Attitude.

when, through tiresomeness by sitting in one posture, his colour alters to what weariness usually creates. On which account, it is best to keep to the sitter's usual tint, a little improved. He may also rise, and take some turns about the room, to gain fresh spirits, and shake off or prevent tiresomeness.

In *draperies*, all sorts of colours do not suit all sorts of persons. In men's portraits, we need only observe great truth and great force: but in women's there must also be charms; whatever beauty they have must appear in a fine light, and their blemishes must by some means or other be softened. For this reason, a white, lively, and bright tint, ought never to be set off by a fine yellow, which would make it look like plaster; but rather by colours inclining to green, blue, or gray, or such others as, by the opposition, they make the tint appear more fleshy than usual in fair women. Vandyke often made a fillemot coloured curtain for his ground; but that colour is soft and brown. Brown women, on the other hand, who have yellow enough in their tints to support the character of fleshiness, may very well have yellowish draperies, in order to bring down the yellow of their tints, and make them look the fresher; and near very high coloured and lively carnations, linen does wonders.

In *grounds*, two things are observable; the tone and the colour. The colour is to be considered in the same manner as those of draperies, with respect to the head. The tone must be always different from the mass it supports, and of which it is the ground, that the objects coming upon it may not seem transparent, but solid and raised. The colour of the hair of the head usually determines the tone of the ground; and when the former is a bright chesnut, we are often embarrassed, unless helped by means of a curtain, or some accident of the claro-obscuro supposed to be behind, or unless the ground is a sky.

We must further observe, that where a ground is neither curtain nor landscape, or such like, but is plain and like a wall, it ought to be very much party-coloured, with almost imperceptible patches or stains; for, besides its being so in nature, the picture will look the more grand.

Of Attitude, or *Posture*.—Attitudes ought to suit the age and qualities of persons and their tempers. In old men and women, they should be grave, majestic, and sometimes bold: and generally, in women, they ought to have a noble simplicity and modest cheerfulness; for modesty ought to be the character of women; a charm infinitely beyond coquetry! and indeed coquettes themselves are not to be painted such.

Attitudes are of two kinds: one in motion, the other at rest. Those at rest may suit every person: but those in motion are proper for young people only, and are hard to be expressed; because a great part of the hair and drapery must be moved by the air; motion, in painting, being never better expressed than by such agitations. The attitudes at rest must not appear so much at rest as to seem to represent an inactive person, and one who sits for no other purpose but to be a copy. And though the figure that is represented be at rest, yet the painter, if he thinks fit, may give it a flying drapery, provided the scene or ground be not a chamber or close place.

It is above all things necessary that the figures which are not employed should appear to satisfy the spectator's curiosity; and for this purpose show themselves in such an action as suits their tempers and conditions, as if they would inform him what they really were: and as most people pretend to sincerity, honesty, and greatness of mind, we must avoid in attitudes, all manner of affectation; every thing there must appear easy and natural, and discover more or less spirit, nobleness, and majesty, in proportion to the person's character and dignity. In a word, the attitudes are the language of portraits; and the skilful painter ought to give great attention to them.

But the best attitudes are such as induce the spectator to think that the sitter took a favourable opportunity of being seen to advantage, and without affectation. There is only one thing to be observed with regard to women's portraits, in whatever attitude they are placed; which is, that they sway in such a manner as to give the face but little shade; and that we carefully examine whether the lady appear most beautiful in a smiling or in a serious air, and conduct ourselves accordingly. Let us now proceed to the next article.

Practice in Portraiture.

Of Practice in Portraiture.—According to De Piles, portraiture requires three different sittings and operations; viz. dead colouring, second colouring, and retouching or finishing. Before the painter dead colour, he must attentively consider what aspect will best suit the sitter, by putting him in different positions, if we have not any settled design before us: and when we have determined this, it is of the last consequence to put the parts well together, by comparing always one part with another; for not only the portrait acquires a greater likeness when well designed, but it is troublesome to make alterations at the second sitting, when the artist must only think of painting, that is, of disposing and uniting his colours.

Experience tells us, that the dead colouring ought to be clean, because of the slope and transparency of the colours, especially in the shades: and when the parts are well put together, and become clammy, they must be judiciously sweetened and melted into each other; yet without taking away the air of the picture, that the painter may have the pleasure of finishing it, in proportion as he draws. But if fiery geniuses do not like this method of scumbling, let them only mark the parts slightly, and so far as is necessary for giving an air.

In dead colouring, it is proper to put in rather too little than too much hair about the forehead; that, in finishing, we may be at liberty to place it where we please, and to paint it with all possible softness and delicacy. If, on the contrary, you sketch upon the forehead a lock which may appear to be of a good taste, and becoming the work, you may be puzzled in finishing it, and not find the life exactly in the same position as you would paint it. But this observation is not meant for men of skill and consummate experience, who have nature in their heads, and make her submit to their ideas.

The business of the second sitting is, to put the colours well in their places, and to paint them in a manner that is suitable to the sitter and to the effect we propose: But before they are made clammy, we ought to examine afresh whether the parts are rightly placed, and

Practice of Vandyke.

and here and there to give some touches towards likeness, that, when we are assured of it, the work may go on with greater satisfaction. If the painter understands what he is about, and the portrait be justly designed, he ought as much as possible to work quick; the sitter will be better pleased, and the work will by this means have the more spirit and life. But this readiness is only the effect of long study and experience; for we may well be allowed a considerable time to find out a road that is easy, and such as we must often travel in.

Before we retouch or finish, it is proper to terminate the hair, that, on finishing the carnations, we may be abler to judge of the effect of the whole head.

If, at the second sitting, we cannot do all we intended, which often happens, the third makes up the loss, and gives both spirit, physiognomy, and character.

If we would paint a portrait at once, we must load the colouring; but neither sweeten, nor drive, nor very much oil it: and if we dip the pencil in varnish as the work advances, this will readily enable us to put colour on colour, and to mix them without driving.

The use and sight of good pictures give greater light into things than words can express: What hits one artist's understanding and temper may be disagreeable to another's; and almost all painters have taken different ways, though their principles were often the same.

We are told that a friend of Vandyke's having observed to him how little time he bestowed on his portraits, Vandyke answered, "That at first he worked hard, and took great pains, to acquire a reputation, and also to get a swift hand, against the time he should work for his kitchen." Vandyke's custom is said to have been this: He appointed both the day and hour for the person's sitting, and worked not above an hour on any portrait, either in rubbing in or finishing; so that as soon as his clock informed him that the hour was out, he rose up, and made a bow to the sitter, to signify, that he had done enough for that day, and then appointed another hour some other day; whereupon his servant came to clean his pencils, and brought a fresh pallet, whilst he was receiving another sitter, whose day and hour he had before appointed. By this method he worked on several pictures the same day, with extraordinary expedition.

After having lightly dead-coloured the face, he put the sitter into some attitude which he had before contrived; and on a gray paper, with white and black crayons, he designed, in a quarter of an hour, his shape and drapery, which he disposed in a grand manner, and an exquisite taste. After this, he gave the drawing to the skilful people he had about him, to paint after the sitter's own clothes, which, at Vandyke's request, were sent to him for that purpose. When his disciples had done what they could to these draperies, he lightly went over them again; and so, in a little time, by his great knowledge, displayed the art and truth which we at this day admire in them. As for hands, he had in his house people of both sexes, whom he paid, and who served as models.

This conduct of Vandyke, however, is mentioned rather to gratify the reader's curiosity than to excite his imitation; he may choose as much of it as he pleases, and as suits his own genius, and leave the rest.

Judgment of Tints.

We must observe by the way, that there is nothing so rare as fine hands, either in the design or colouring. It is therefore convenient to cultivate, if we can, a friendship with some woman who will take pleasure in serving for a copy: The way to win them is, to praise their beauty exceedingly. But if an opportunity serves of copying hands after Vandyke, it must not be let slip; for he drew them with a surprising delicacy, and an admirable colouring.

It is of great service to copy after the manners which come nearest to nature; as are those of Titian and Vandyke. We must, at such times, believe them to be nature itself; and, at some distance, consider them as such, and say to ourselves—*What colour and tint shall I use for such a part?* And then, coming near the picture, we ought to examine whether we are right or not; and to make a fixed rule of what we have discovered, and did not practise before without uncertainty.

It is recommended, before we begin colouring, to catch the very first moments, which are commonly the most agreeable and most advantageous, and to keep them in our memory for use when we are finishing: for the sitter, growing tired with being long in the same place, loses those spirits, which, at his first sitting down, gave beauty to the parts, and conveyed to the tint more lively blood, and a fresher colour. In short we must join to truth a probable and advantageous possibility, which, far from abating likeness, serves rather to set it off. For this end, we ought to begin with observing the ground of a tint, as well what it is in lights as in shades; for the shades are only beautiful as they are proportioned to the light. We must observe, if the tint be very lively, whether it partake of yellowness, and where that yellowness is placed; because usually, towards the end of the sitting, fatigue diffuses a general yellowness, which makes us forget what parts were of this colour, and what were not, unless we had taken due notice of it before. For this reason, at the second sitting, the colours must be everywhere readily clapped in, and such as appear at the first sitting down; for these are always the finest.

The surest way to judge of colours is by comparison; and to know a tint, nothing is better than to compare it with linen placed next it, or else placed next to the natural object, if there be occasion.—We say this only to those who have little practised nature.

The portrait being now supposed to be as much finished as you are able, nothing remains, but, at some reasonable distance, to view both the picture and sitter together, in order to determine with certainty, whether there is any thing still wanting to perfect the work.

SECT. IV. *Of Theatrical Decorations; the Designs for Furniture, Embroidery, Carriages, &c.*

Of Theatrical Decorations.—This is a particular art, which unites several of the general parts of painting with the knowledge of architecture, perspective, &c. They

Theatrical Decorations, &c.

They who apply themselves to it would do well to design their decorations by day, and to colour them by candle light, as they will be much better able to judge of the effect of a painting intended to be viewed by that light. It is proper also to caution the young painter to avoid, as much as possible, the uniting the imitations of nature with nature itself; that is, he should not introduce with his decorations living horses, or other animals, real fountains or cascades, trees, or statues, &c. For such combinations are the effect of ignorance and a bad taste; they are the resource of painters of little ability; they discover a sterility of invention, and produce great inconvenience in the representation. Those pieces which they call moving pictures, where the painted landscape remains immoveable, and the figures move by means of springs, form a part of these decorations; and there are some of them, as those of Antwerp and Ghent, that have a pleasing effect.

The designs for *furniture*, *carriages*, *porcelain*, and other branches of manufacture, form also a very important article of painting in general, and of academy painting in particular. This is a distinct branch of the art; and without doubt not the least useful of its parts, as it concurs so essentially to the success of manufactures, and consequently to the prosperity of a state: and it is an art, to which it were much to be wished that youth of ability and invention would apply themselves. See the articles JAPANNING and PORCELAIN.

SECT. V. *Enumeration of the different Methods of Painting, or the different Means and Materials that Painters make use of to imitate all visible Objects on a plane Superficies.*

THOSE now in practice are,

1. Painting in OIL; which is preferable to all other methods, as it is more susceptible of all sorts of expressions, of more perfect gradations of colours, and is at the same time more durable.

2. MOSAIC painting; an invention truly wonderful. It is composed of a great number of small pieces of marble of different colours, joined together with stucco. The works of this kind are made principally at Rome, where this art has been carried so far as to resemble the paintings of the greatest masters; and of these are made monuments for the latest posterity.

3. Painting in FRESCO; which is by drawing, with colours diluted with water, on a wall newly plastered, and with which they so incorporate, that they perish only with the stucco itself. This is principally used on ceilings.

4. Painting in WATER COLOURS; that is, with colours mixed with water and gum, or paste, &c.

5. MINIATURE painting; which differs from the preceding as it represents objects in the least discernible magnitudes.

6. Painting in CRAYONS; for which purpose colours, either simple or compound, are mixed with gum, and made into a kind of hard paste like chalk, and with which they draw on paper or parchment.

7. Painting in ENAMEL; which is done on copper or gold, with mineral colours that are dried by fire, and become very durable. The paintings on the PORCELAIN of China and Europe, on Delft ware, &c. are so many sorts of enamel.

8. Painting in WAX, or ENCAUSTIC painting: This is a new, or rather an old invention renewed, in which there are in France performances highly pleasing. It is done with wax mixed with varnish and colours.

9. Painting on GLASS; of which there are various kinds.

See all the articles here enumerated, explained in the order of the alphabet. On one of them, however, some additional observations may here be subjoined.

Fresco.

§ 1. *Of Painting in Fresco.*

OF all kinds of painting, fresco is the most ancient, the most durable, the most speedily executed, and the most proper to adorn great buildings. It appears, that the fragments of ancient painting handed down to us by the Romans are all in fresco. Norden, quoted by Winkleman, speaks of the ruins of Egyptian palaces and temples, in which are colossal paintings on walls 80 feet high. The description which those authors have given of these paintings, of the prepared ground, and of the manner in which the colours have been employed, &c. shows plainly that they have been executed in fresco.

The stability of fresco is demonstrated by the existence of those fragments of the highest antiquity. There are no other kinds of painting which could equally have resisted the injuries of the weather, the excessive aridity of certain climates, the moisture of subterraneous situations, and the encroachments of barbarians.

There are different opinions concerning the climate most proper to preserve this kind of painting. "It is observed (says Felibien), that the colours in *fresco* fade sooner in Italy and Languedoc than at Paris; perhaps from less heat in the last-mentioned place, or better lime." M. Falconet contradicts this assertion in his notes on Pliny, vol. i. p. 223. of his miscellaneous works, published at Paris 1787. Painting in fresco, according to this author, is longer preserved in dry and warm, than in northern and moist climates. However opposite the sentiments of these two authors may appear to be, it is possible to reconcile them, when we consider, that the exposure to a burning sun is capable of operating a great change of the colours on the one hand, and that the frost in a cold climate inevitably destroys the paintings of fresco on the other. Frost is capable of bursting stones, of corroding the petrified veins of earth in the heart of coloured marble, and, in short, nothing can resist its destructive operation.

These observations on fresco paintings lead us to conclude, that the choice of place, when they are without doors, is of the greatest importance. In countries where there is little or no frost, an exposure to the north is the most favourable; and in cold climates a western exposure should be made choice of, because the first rays of the rising sun have a very pernicious effect after frost. We are not, however, wholly to adopt the sentiment of M. Falconet with regard to the pernicious effects of moisture on fresco paintings: for, 1. The ancient paintings recovered from moist places, in which they were buried for many ages, have, under enormous heaps of earth, preserved all their colours. Those from the ruins of Herculaneum have been observed, Fresco.

served, on the contrary, to lose their colours in a short time after they have been dried by the exterior air. 2. The mortar which composes the ground of this painting is not destroyed in our rainy climates. It is necessary frequently to use powder in removing pieces of this mortar, which are now found to obstruct some buildings in Paris.

After the choice of place, the choice of materials is the next thing of importance in executing fresco. To make it durable, the ground is the object of chief attention; and to make this perfect, the mortar used by the ancients, now unknown, would be necessary.

It is easy to perceive, that a minute detail of forms, an extensive mixture and gradation of tints, and the merit of a delicate and gentle touch, can make no part of the excellencies of this kind of painting. It cannot bear a close examination like a picture in oil. There is always something dry and rough which displeases. An artist who would flatter himself with success in a fresco placed near the eye would be grossly deceived: a common spectator would find it coarse and badly finished.

Fresco is chiefly employed in palaces, temples, and public edifices. In these vast places no kind of painting can be preferred to it; large, vivid in its strokes, and constantly fresh, it enriches the architecture, animates it, and gives relief to the eye from the repetition of the same forms, and the monotony of colour in a place where coloured marbles and bronzes are not employed. Still more a fine fresco gives the greatest effect to a lofty building, since this building serves as a frame and support to this enchanting art, which fixes the attention of every person of sensibility and taste.

We shall afterwards have occasion to show the manner of executing fresco, as well as the nature and application of the colours employed in it; it is necessary to demonstrate here, that it has a freshness, splendour, and vigour not to be found in oil or water colours.

A known principle in all kinds of painting is, that the colouring is more perfect in proportion as it approaches to the lights and shades in nature. As colours applied to any subject can never reach this degree of perfection, the illusion which painters produce consists in the comparison and opposition of the tones of colours among themselves.

If the white of the finest and purest oil appears heavy and gray, compared with great lights in natural whites, it follows, that, in order to copy them with fidelity, the tones which follow the first white must be degraded in an exact proportion. Thus it is necessary that the shades of a picture be considerably deeper than those of the model; especially if, from the greatest lights to the browns, one hath proportionally followed the distance which is found between the colours on the pallet, and the tones of the object copied.

Now if the white of fresco be infinitely more bright than that of oil, the same effect will be obtained in a brown tone. On the other side, if it constantly happens that the brown tones of fresco are much more vigorous than those of water colours, and equal even to the browns of oil itself, it is certain that it possesses a splendour and vigour more extensive than any other kind of painting. Thus in the hands of an artist who is well acquainted with the colours fit for fresco, it is more susceptible of the general effect, and more capable than any other kind, of giving projection and the semblance of life to the figures.

If we were to inquire why painting in fresco is now scarcely or never practised, we should perhaps ascribe it to the great talents required to execute it. "Many of our painters (says Vasari in his Treatise on Painting) excel in oil or water colours, and yet fail in fresco; because of all kinds this requires the greatest strength of genius, boldness in the strokes, and resolution." If in an age abounding in great masters, it was difficult to excel in this kind, it must be much more so in ours; but we should not require the characters of sublimity and style to which men were accustomed in the time of Vasari.

We should execute in fresco as we do in oils; for Italy herself, along with Michael Angelo and Zuicharo, had Cortonni Giardano and Francischini as middling fresco painters. And in France, Lafosse, Bon-Boulogne, and Perur, performed several works in fresco which might be imitated by the painters of our times. But let us proceed to the real causes for abandoning this art. These proceed from the want of knowledge and taste in the persons who employ the artists, and from the manners of the age. As a pleasant or licentious conceit, unfinished colouring, and bold effects of shade, are the chief objects of consideration, a very smooth painting enlivened by gentle touches completely gratifies the person who pays the price; and therefore the philosophical principles of the art, which require study, are not cultivated.

We shall now attend to the mechanical process of this useful and beautiful kind of painting. Before painting, it is necessary to apply two layers. If the wall on which you are to paint is of brick, the layer is easily applied; but if it is of free stone closely united, it is necessary to make excavations in the stone, and to drive into them nails or pegs of wood in order to hold the first layer.

The first layer is made of good lime and a cement of pounded brick, or, which is still better, river sand: this latter forms a layer more uneven, and better fitted to retain the second smooth and polished layer applied to its surface.

There should be experiments to discover a layer still more compact, and more independent of the variations of the air; such for example, as covers the aqueducts and ancient reservoirs constructed by the Romans in the neighbourhood of Naples.

Before applying the second layer, or what you are to paint, it is necessary that the first be perfectly dry, for there issues from the lime, when it is moist, a smell both disagreeable and pernicious to the artist.

When the first layer is perfectly dry, it is wet with water in proportion to its dryness, that the second layer may the more easily incorporate with it.

The second layer is composed of lime, slaked in the air, and exposed for a year, and of river sand, of an equal grain, and moderately fine.

It requires an active and intelligent mason to apply this layer, as the surface must be altogether equal. The operation is performed with a trowel; and the operator requires to have a small piece of wood to take away the large grains of sand, which, remaining, might render the surface uneven.

To

Fresco.

To give a fine polish to this layer, one ought to take a sheet of paper, apply it to the wall, and pass and repass the trowel over the paper. By this means the little inequalities which hurt the exactness of the stroke, and which produce false appearances at a distance, are entirely smoothed.

The artist must not lay more than the painter can finish in a day, as this kind of painting must be executed on a fresh ground.

The layer being thus prepared, the painter begins his operation; but as painting in fresco must be executed rapidly, and as there is no time to retouch any of the strokes, the painter, as we have observed under the article Fresco, takes care to provide himself with large cartoons, on which he has drawn, with exactness, and in their full size, the figures which he is to paint, which leaves him nothing to do but to copy them on the wall.

The cartoons are composed of several sheets of large paper pasted one on another, neither too thick nor too slender.

The painter traces the tracks of the figures on the plaster, by passing a steel point over the tracks in the cartoons, or in pricking them.

Having in this manner attained an exact and speedy drawing, it now remains to execute the painting.

But it is essential, when one wishes to finish any small work of this kind, in the first place to be informed of the proper colours, and of those which cannot be used.

In general, the colours which are extracted from earths, and those which have passed through the fire, are the only ones which can be employed in this kind of painting.

The colours are white, made of lime, the white of egg shells, ultramarine; the black of charcoal, yellow ochre, burnt vitriol, red earth, green of Verona, Venetian black, and burnt ochre.

There are others which require to be used with great precaution, such as enamel blue, cinnabar, and white marble dust.

When enamel blue is used, it requires to be applied instantaneously, and when the lime is very moist, otherwise it does not incorporate with the plaster; and if one retouch with this colour, it must be done an hour or more after the first application, to increase its lustre.

With regard to the white marble dust, it is subject to turn black if it be not mixed up with a convenient quantity of white lime.

Cinnabar, which has a splendour almost superior to all other colours, loses it almost entirely when mixed with lime. At the same time, it may be employed in places not exposed to the air, with a little degree of care in the preparation. Reduce a quantity of the purest cinnabar to powder, put it into an earthen vessel, and pour lime water on it, for two or three times. By this process the cinnabar receives some impression of lime water, which makes it capable of being employed in fresco painting.

One of the best colours, and the one most used in fresco for the gradation of tints, and for giving the requisite tone, is white of lime. This white is prepared by mixing lime slaked long before with good water. The lime deposits a sediment at the bottom of the vessel; when the water is poured off, this sediment is the white of lime.

Another kind of white might be used, the effects of which would be known by experience, namely, the white of egg shells. To prepare this white, one must take a great quantity of shells of eggs, which must be pounded and boiled in water along with a quantity of quicklime; after this they are put into a strainer, and washed repeatedly with fountain water.

The shells are again pounded until the water employed for that purpose become pure and limpid; and when they are in this manner reduced to powder, this powder is grinded in water, and formed into small pieces, and dried in the sun.

All the different kinds of ochres make excellent colours for fresco, and take different shades, being previously burned in iron chests.

With regard to the Naples yellow, it is dangerous to use it where the painting is much exposed to the air. The blacks of charcoal, of peach stones, and of vine twigs, are good: but that extracted from bones is of no value.

Roman vitriol gathered at the furnaces, and which is called *burnt vitriol*, grinded afterwards in spirit of wine, resists the air extremely well when employed in lime. There is also a red extracted from this preparation somewhat like that produced from lac.

This colour is very proper for preparing the layers, to be coloured with cinnabar; and the draperies painted with these two colours will vie in splendour with those painted with fine lac in oil.

The ultramarine is the most faithful colour; and it not only never changes, but it communicates this precious quality to those colours with which it is mixed.

The manner of employing those colours, is to grind them in water, and to begin by arranging them into the principal tints you are to employ: these are afterwards put into pots; and it is necessary to use a great many pallets raised at the edges, to form the intermediate shades, and to have under your eye all the shades you require.

As all the tints, except burnt ochre, violet, red, and blacks of all kinds, are apt to become clear, the painter must have beside him some pieces of brick or new tile very dry. A dash of the colours is applied to one of these with the pencil before using them; and as the tile instantaneously imbibes the water, one perceives what the shade will be after the fresco is dry.

§ 2. *Elydoric Painting, invented by M. Vincent of Montpetit.*

This new kind of painting is little known, and capable of great improvement.

Its principal advantages are, that the artist is able to give the greatest finishing possible to small figures in oil; to add to the mellowness of oil painting, the greatest beauty of water colours in miniature, and to do it in such a manner that it appears like a large picture seen through a glass which diminishes objects.

This kind of painting takes its name from two Greek words expressive of *oil* and *water;* because those two liquids are employed in the execution. The following is the manner of proceeding: A piece of very fine linen, Elydoric Painting.

linen, or of white taffety, is sized with starch, in the most equal manner possible, on pieces of glass about two inches square, the angles of which are blunted in order that the cloth may cover them neatly and without wrinkles.

When these pieces of cloth are sufficiently dry, a layer composed of white lead finely grinded, and oil of pinks or of poppies, the whitest that can be found, is applied to them with a knife. When this layer is dry enough to admit of scraping, more may be applied if necessary.

As it is of the greatest importance for the preservation of this kind of painting, that the different layers be purged of oil, in order that they may imbibe the colours applied to them, it is necessary that their surface be very smooth, very dry, and very hard.

The artist is next provided with a circle of copper nearly two inches in diameter, one-fourth of an inch in height, extremely thin, and painted on the inside with black. This circle is employed to contain the water on the surface of the picture.

The preference is given to water distilled from rain or snow; because ordinary water, from the salts which it contains, is pernicious to this kind of painting.

It is necessary also to observe, that the colours must be grinded between two oriental agates, most carefully preserved from dust, and mixed with oil of poppies, or any other siccative oil which has been extracted without fire, and pure as water.

All the colours being grinded, they are placed in a small heap on a piece of glass, which is covered with distilled water in a tin box.

When the materials are thus prepared, the subject is slightly traced on one of the pieces of cloth above mentioned with a lead pencil.

The tints are formed on the pallets from the heaps of colours under the water, and the pallet placed as usual on the left arm with the thumb through the aperture.

The picture is held between the thumb and fore finger, supported by the middle, and the necessary pencils between the third and little fingers. The hand is supported on the back of a chair, that there may be full liberty of bringing the work near, or keeping it at a distance from the eye.

The pencils are cleaned with the essence of rectified turpentine.

After having made the rough draught with the colours still fresh, the circle of copper, which ought to surround the picture, is fitted exactly to the surface.

The distilled water is poured within this circle to the height of one eighth part of an inch; and the body is leaned forward till the light fall perpendicularly on the object.

The third finger of the right hand must rest on the internal right angle of the picture.

The artist, with a fine and firm pencil, runs over the first draught, to give colours to the weak places, and to soften those which appear too strong.

As soon as the oil swims on the top, the water is poured off, and the picture is carefully covered with a watch glass, and dried in a box with a gentle heat.

When it is sufficiently dry, to be scraped almost to a level with the knife: the above operation is renewed till the artist is satisfied with his work.

It is in this last work that the artist feels all the advantage of this new method for finishing.

The water poured on the picture discovers all the faults of the pencil, gives facility in searching into the bottom of the shades, and the power of correcting the work and of rendering it perfect.

When the work is finished, it is put under a crystal, where there is no admission of external air, and dried with a gentle heat.

PART III. OF ECONOMICAL PAINTING.

SECT. I.

THE object of this Part is to give an account of some mechanical proceedings in certain kinds of painting, calculated to preserve and embellish the walls of houses and furniture. This branch of the art extends to every part of architecture. The whole building becomes the workshop of the artist; the stairs, the balustrades, the sashes, the doors, and the railing of all kinds, occupying his first care, and then the ceiling and wainscotting.

The artist gives to all his subjects a chosen and uniform tint; but he has it in his power to vary the colours on different parts of the building in such a manner as to produce the most pleasing objects.

22 Of the utensils for this kind of painting.

Among the utensils of the painter, it is needless, but for rendering the article complete, to mention brushes and pencils of all sizes as absolutely necessary.

The brushes are made of boars bristles, or of hair with a mixture of bristles; they ought to be straight, very smooth, and of a round form. Half an hour before they are used, it is proper to soak them in water, in order to swell the wood of the handle, and prevent the hairs from falling off; after this they may be applied to all purposes, either in water colours or in oil; but it may be observed that for the former they require less softening.

The pencils are made of badgers hair, or any fine hairs enchased in the pipes of quills of all sizes.

The vessel wherein the pencils are cleaned is made of copper or of tin, smooth below, rounded at the ends, and divided into two parts by a thin plate in the middle. The oil, or the substance with which the pencil is cleaned, is contained in one of the divisions.

The pallet is made of the wood of the pear or apple tree, of an oval or square shape, very slender, but somewhat thicker at the centre than at the extremities. A hole is made in one of its sides sufficiently large to admit the thumb of the workman.

When the pallet is new, it is covered with oil of walnuts; and as often as it dries, the operation is repeated, till it be fully impregnated; it is afterwards polished, and finally rubbed with a piece of linen dipped in oil of common nuts.

The painter's knife is a thin flexible plate, equally slender

Application of Colours.

slender on both sides, rounded at one extremity, and the other fixed into a handle of wood.

All the vessels employed to hold the colours should be varnished; a precaution necessary to prevent their drying too quickly.

23 Of grinding and diluting the colours.

To grind, is to reduce to powder the substances which give colours on a piece of marble or any hard stone by means of water, oil, or essence.

To dilute, is to impregnate a liquid with a tint in such a manner as to make it capable of being applied by a brush.

When the materials are grinded in water, it is proper to dilute them in size made from parchment. If they are diluted in spirit of wine, there must be no more diluted than what serves the immediate occasion, as colours prepared in this manner dry very rapidly.

Colours grinded in oil are sometimes diluted with pure oil, more frequently with oil mixed with essence, and commonly with the pure essence of turpentine; the essence makes the colours easy to work. Those prepared in this manner are more solid, but they require more time to dry.

When colours are grinded with the essence of turpentine, and diluted in varnish, as they require to be immediately applied, it is necessary to prepare a small quantity at a time. This preparation of colours gives greater brilliancy, and dries more speedily, than those prepared in oil; but they require more art to manage them.

They grind colours or coloured substances with a mullar, which is employed on the stone till they become a very fine powder. The operation is facilitated by moistening them from time to time with a little water, and by collecting them under the mullar with the knife. They are afterwards laid in small heaps on a sheet of white paper, and allowed to dry in a situation not exposed to dust. Those who grind white lead have a stone for the purpose, as this colour is very easily tarnished. In executing this part well, it is necessary to grind the colours equally and moderately; to grind them separately, and not to produce a tint by mixture till the colours are well prepared.

Dilute no more at a time than what you have occasion to employ, to prevent them from growing thick.

In grinding the colours, put in no more liquid than what is necessary to make the solid substances yield easily to the mullar; the more the colours are grinded, they mix better, and give a smoother and more agreeable painting.

It is also necessary to give all attention to the grinding and diluting of colours, that they may be neither too thick nor too thin.

Sect. II. *Application of Colours.*

1. Prepare only the quantity necessary for the work you undertake, because they do not keep long: and those which are newly mixed are more vivid and beautiful.

2. Hold the brush straight before you, and allow only the surface to be applied to the subject: if you hold it inclined in any other direction, you will run the hazard of painting unequally.

3. It is necessary to lay on the colours boldly, and with great strokes; taking care at the same time to spread them equally over the surface, and not filling up the moulding and carved work. If this accident should happen, you must have a little brush to clean out the colours.

Application of Colours.

4. Stir them frequently in the vessel, that they may preserve always the same tint, and that no sediment may remain at the bottom.

5. Take care not to overcharge the brush with the colour.

6. Never apply a second layer till the first or preceding one be perfectly dry; which it is easily known to be when, in bearing the hand gently over it, it does not adhere.

7. In order to render this drying more speedy and uniform, make always the layers as thin as possible.

8. Before painting, it is necessary to prime the subject; that is, to give it a layer of size, or of white colouring oil, to fill up the pores, and render the surface smooth: by this means fewer layers of colour or of varnish are afterwards necessary.

9. Every subject to be painted or gilded ought to have first a white ground; this preserves the colours fresh and vivid, and repairs the damage which they occasionally receive from the air.

§ 1. *Of Painting in Water Colours.*

To paint in water colours, is to do it in those which are grinded in water and diluted in size. There are three kinds of this painting; namely *common*, the *varnished*, and that which is called *king's white*; but before entering on these, it is necessary to make some preliminary observations.

1. Take care that there be no grease on the subject; and if there be, scrape it off, or clean it with a lye, or rub the greasy part with garlic and wormwood.

2. Let the diluted colour fall in threads from the end of the brush when you take it out of the vessel; if it adheres to it, it is a proof that it wants size.

3. Let all the layers, especially at the beginning, be laid on very warm, provided that the liquid be not boiling, which would effectually spoil the subject; and if on wood, expose it to crack. The last layer, given immediately before the varnish, is the only one which ought to be applied cold.

4. In very fine work, where it is necessary to have beautiful and solid colours, the subjects are prepared by size and proper whites, which serve as a ground to receive the colour, and render the surface very equal and smooth.

5. Whatever colour is to be laid on, the white ground is the best, as it assimilates most easily with the painting, which borrows always something of the ground.

6. If knots of wood are found in the subject, it is necessary to rub them with garlic, to make the size adhere.

To make the following details sufficiently plain, we shall take the measures to which the quantity of colours are applied at fathoms; that is to say, six feet in height by six feet in breadth. We shall afterwards fix the quantity of materials, and of liquids, necessary to cover this surface. This, however, cannot be exactly defined, as some subjects imbibe the colours much more than others. The manner of employing them also makes a difference; as habit enables one to manage them to greater

Application of Colours

greater advantage than another. And it is also to be observed, that the first layer will consume more than the second; and that a prepared subject requires less than one which has not been so.

When we speak of a fathom, it must be understood of a smooth and equal surface; for if the wood is varied with mouldings and carving, there must be a difference in the quantity of colours. In general, it requires about a pound of colours to paint a square fathom in water colours. In making up this quantity, take three-fourths of colours grinded in water, and one-fourth pound, or six ounces, of size to dilute it.

§ 2. *Of Painting in common Water Colours.*

Works which require no great care or preparation, as ceilings and staircases, are generally painted in common water colours, i. e. with earths infused in water and diluted in size.

For a common white kind of this painting, steep Spanish white moderately pounded in water for two hours. Infuse a proper quantity of the black of charcoal in water for the same space of time: mix the black and white in the proportion that the tint requires; afterwards mix them up with a pretty strong size sufficiently thick and warm, and apply them to the subject in as many layers as may be thought necessary. It requires about two pounds of white in a pint of water, and a quantity of black in proportion to the tint, together with a part of size, to cover a square fathom. If this be employed on old walls, they must be well scraped, the dust brushed off with a hair besom, and washed carefully with lime water. If on new plaster, the colours require more size.

All kinds of colours may be grinded in water only when the tint is made; and when they have been infused in water, they must be mixed up with size.

§ 3. *Walls done with the White* Des Carmes.

The white *des carmes* is a manner of whitening interior walls, whereby they are rendered extremely beautiful.

1. Procure a quantity of the very best lime, and pass it through fine linen; pour it into a large tub, furnished with a spigot at the height equal to that which the lime occupies: fill the tub with clear fountain water; beat the mixture with great pieces of wood, and then allow it to settle for 24 hours.

2. Open the spigot, allow the water to run off, supply the tub with fresh water, and continue this operation for several days until the lime receives the greatest degree of whiteness.

3. When you allow the water finally to run off, the lime will be found in the consistency of paste; but with the quantity you use it is necessary to mix a little Prussian blue or indigo to relieve the brightness of the white, and a small quantity of turpentine to give it brilliancy. The size proper for it is made of glove leather, with the addition of some alum; and the whole is applied with a strong brush in five or six layers to new plaster.

4. The wall is strongly rubbed over with a brush of hogs bristles after the painting is dry; which gives it its lustre and value, and which makes it appear like marble or stucco.

§ 4. *Of Badegeon.*

Badegeon is a pale yellow colour applied to plaster to make it appear like free stones. It gives to old houses and churches the exterior of a new building, by assuming the colour of stones newly cut.

1. Take a quantity of lime newly killed.

2. Add to it half the quantity of what the French called *sciure de pierre* in which you have mixed of the ochre of *rue*, according to the colour of the stone you intend to imitate.

3. Steep the whole in a pail of water, in which is melted a pound of rock alum. When the *sciure de pierre* cannot be obtained, it is necessary to use a greater quantity of ochre *de rue*, or of yellow ochre, or grind the scales of the stone de St Leu; pass it through a sieve: and along with the lime it will form a cement, on which the weather will scarcely make any impression.

§ 5. *Of Ceilings and the Roofs of Rooms.*

When the ceilings or roofs are new, and you wish to whiten them, take white of Bougival, to which add a little of the black of charcoal to prevent the white from growing reddish; infuse them separately in water; mix the whole with half water and half size of glove leather, which being strong would make the layer come off in rolls if it were not reduced with water. Give two layers of this tint while it is lukewarm.

If the roof has been formerly whitened, it is necessary to scrape to the quick all the remaining white; then give it two or three layers of lime to ground and whiten it: Brush it carefully over; and give it two or three layers of the white of Bougival prepared as before.

§ 6. *Of Colouring the backs of Chimneys with Lead Ore.*

Clean them with a very strong brush, and carefully rub off the dust and rust; pound about a quarter of a pound of lead ore into a fine powder, and put it into a vessel with half a pint of vinegar; then apply it to the back of the chimney with a brush: When it is made black with this liquid, take a dry brush, dip it in the same powder without vinegar, and dry and rub it with this brush till it become shining as glass.

§ 7. *Of Varnished Water Colours.*

The advantages of this kind of painting are, that the colours do not fade; that they reflect the light; that they give no offensive smell, but permit the places to be inhabited as soon as finished; and that the varnish preserves the wood from insects and moisture.

To make a fine varnish on water colours, seven principal operations are necessary; namely, to size the wood, to prepare the white, to soften and rub the subject, to clean the moulding, to paint, to size, and to varnish.

To size the wood is to give one or two layers of size to the subject which you intend to paint. 24

First operation.

Take three heads of garlic and a handful of wormwood leaves; boil them in three pints of water till they are reduced to one; pass the juice through a linen cloth, and mix it with a pint of parchment size; add half a handful of salt and half a pint of vinegar; and boil the whole on the fire.

Size

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Size the wood with this boiling liquor; allow it to penetrate into the carved and smooth places of the wood, but take care at the same time to take it as clean off the work as possible, or at least to leave it at no place thicker than another. This first sizing serves to fill up the pores of the wood, and to prevent the materials afterwards from collecting in a body, which would cause the work to fall off in scales.

In a pint of strong parchment size, to which you have added four pints of warm water, put two handfuls of white Bougival, and allow it to infuse for the space of half an hour.

Stir it well, and give a single layer of it to the subject very warm but not boiling, equally and regularly laid on, and dashed with repeated strokes of the brush into the mouldings and carved work.

25 Second operation. To prepare the white, take a quantity of strong parchment size, and sprinkle lightly over it with the hand, Bougival white, till the size be covered with it about half an inch in thickness; allow it to soak for half an hour as near the fire as to keep it milk warm: and then stir it with the brush till the lumps are broken and it be sufficiently mixed.

Give seven, eight, or ten layers of this white, or as many as the nature of the work or the defects in the wood shall render necessary, giving more white to the parts which require to be softened; but in general, the layers must be equal both with regard to the quantity of the white and the strength of the size.

The last layer of the white ought to be clearer than the rest, which is made by adding water. It must be applied more slightly, taking care with small brushes to cover all the difficult places in the mouldings and carved work. It is necessary also, between the drying of the different layers, to fill up all the defects with white mastich and size.

26 Third operation. To soften, is to give to the subject after the whitening a smooth and equal surface, and to rub it over with a pumice stone.

The wood being dry, take little pieces of white wood and of pumice stone, grinded for the purpose into all necessary forms, either for the pannels or the moulding.

Take cold water, heat being destructive of this kind of work; in summer it is common to add a little ice. Soften the wall with a brush, but only as much at a time as you can easily work, as the water might dilute the white and spoil the whole: Then smooth and rub it with the pumice stones and with the small pieces of wood. Wash it with a brush as you smooth it, and rub it over with a piece of new linen, which gives a fine lustre to the work.

27 Fourth operation. The mouldings and carved work are cleaned with an iron; and the only thing to be attended to in the operation is not to raise the grain of the wood.

The subject thus prepared is ready to receive the colour you intend to give it. Choose your tint; suppose a siver colour.

28 Fifth operation. Grind white ceruse and Bougival white separately in water, of each an equal quantity, and mix them together.—Add a little blue of indigo and a very small quantity of black of charcoal from the vine tree very fine, grinded also separately, and in water; more or less of the one or other gives the tint you require.—Dilute this tint in strong parchment size; pass it through a bolting cloth of silk very fine, and lay the tint on your work, taking care to spread it very equally; and then give it two layers, and the colour is applied.

29 Sixth operation. Make a weak, beautiful, and clean size; stir it till it cools; strain it through a fine cloth, and give two layers to the work with a soft painting brush, which has been used, but which you have been careful to clean. Take care not to choke up the mouldings nor to lay on the size thicker on one place than another, and spread it over the work very slightly, otherwise you will dilute the colours, and occasion undulations in the painting.

The beauty of the work depends on this last sizing; for if any part is omitted, the varnish will penetrate into the colours and give it a darker shade.

30 Seventh operation. When the sizing is dry, lay on two or three layers of spirit of wine varnish, taking care that the place on which you lay it be warm, and the work is finished.

§ 8. *Of the King's White.*

This derives its name from the use of it in the apartments of the French king. It is in all respects conducted like the former, except that there is only a small quantity of indigo, to take the yellow from the white, without any black of charcoal, and without varnish.

This white answers extremely well for apartments which are seldom used; but otherwise it spoils easily, especially in bedchambers. It is the best white where there is any kind of gilding; and in this case it receives a little varnish.

Sect. III. *Of Painting in Oil Colours.*

To paint in oil is to apply to all sorts of subjects, as walls, wood, cloths, and metals, coloured earths grinded and diluted in oil. The ancients are thought to have been ignorant of this art, and the honour of the discovery is generally ascribed to John Van Eyck a Flemish painter. The secret is nothing more than substituting oil in place of water in grinding and diluting colours.

By means of oil the colours are longer preserved; and not drying so speedily, they give painters longer time to smooth, finish, and retouch their works; the colours being more marked, and mixing better together, give more distinguishable tints, and more vivid and agreeable gradations, and the colouring is more sweet and delicate.

The painting in oil consists of two kinds, namely, of that in simple oil and of that in polished oil varnish.

§ 1. *Observations on Painting in Oil.*

1. When bright colours, as white or gray, are grinded and diluted in oil, it is necessary to make use of the oil of walnuts; but if the colours be dark, such as chesnut, or olive, or brown, you must make use of pure linseed oil.

2. When the colours are grinded and diluted in oil, they must be laid on cold, except on a new or moist plaster, which requires them to be boiling.

3. Every colour diluted in pure oil, or in oil mixed with essence, ought to fall in threads from the end of the brush.

4. Take care to stir from time to time your colour before

before taking it up on the brush, that it may preserve an equal thickness, and consequently the same tone. Notwithstanding the precaution of stirring, if it is found to be thicker towards the bottom, it will be necessary to pour in from time to time a little oil.

5. In general, every subject which is painted in oil ought first to receive one or two layers of white ceruse, grinded and diluted in oil.

6. When the painting is exposed to the air, as in doors, windows, and other works, which cannot be varnished, it is necessary to make these layers with pure oil of walnuts, mixed up with about one ounce of essence to a pound of colours; more would make the colours brown, and occasion them to fall off in dust; but this quantity prevents the sun from blistering the work.

7. In subjects on the inside of the house, or when the painting is varnished, the first layer ought to be grinded and diluted in oil, and the last diluted with pure essence.

8. If copper or iron, or other hard substances, are to be painted, it is necessary to mix a little essence with the first layers, to make the oil penetrate into them.

9. When there are many knots in the subject, as is particularly the case with fir wood, and when the colour does not easily take impression on these parts, it is necessary, when you paint with simple oil, to lay on a little oil mixed with litharge on the knots. If you paint with polished oil varnish, it is necessary to apply a hard tint, which we shall have occasion to speak of afterwards. A single layer well applied is generally sufficient to give a body to the wood, and make the other layers apply easily.

10. There are colours, such as what the French call *stils-de-grain*, black of charcoal, and especially bone and ivory blacks, which are difficult to dry when grinded in oil. To remedy this inconveniency, the following siccatives are mixed with the colours, to make them dry, viz. litharge both of the silver and gold colour, vitriol or copperas, and what is called *siccative oil*.

§ 2. *Observations on the Siccatives.*

1. Do not mix the siccatives with the colours till they are to be employed, otherwise it will thicken them.

2. Mix it only in very small quantities in tin, wherein there is white lead or ceruse, because those colours are siccative of themselves, especially when they are diluted in essence.

3. In painting which is to be varnished, give the siccative only to the first layer, and allow the other layers, in which there is essence, to dry of themselves.

4. In dark colours in oil, give to every pound of colours in diluting them half an ounce of litharge; to bright colours, a drachm of white copperas grinded in walnut oil.

5. When in place of litharge or copperas the siccative oil is employed, it requires a quartern of this oil to every pound of colour.

The siccative oil is prepared of one half ounce of litharge, as much of calcined ceruse, as much of *terre d'ombre*, a colour with which the French paint shadows, and as much of talc boiled for two hours on a slow and equal fire, with one pound of linseed oil, and stirred the whole time. It must be carefully skimmed and clarified, and the older it grows it is better.

§ 3. *Observations on the Quantities of Substances and Liquids.*

1. Ochres and earths require more liquids both in grinding and diluting than ceruse.

2. Different quantities of liquids are required in the grinding only on account of greater or less dryness; but in diluting, the quantity is always the same.

3. For the first layer after the priming, which has no relation to the colours laid on afterwards, to a square fathom give fourteen ounces of ceruse, about two ounces of liquid to grind, and four ounces to dilute it. If there is a second layer of the same materials, the quantities will require to be less.

4. It will require three pounds of colour for three layers of a square fathom. The first may consume eighteen ounces, the second sixteen, and the third fourteen.

5. To compose these three pounds of colour, take two or two and a half pounds of grinded colours, and dilute them in a pint or three half pints of oil, mixed with essence or pure oil. But if the first layer of ceruse is not used, there will be a necessity for a greater quantity of colours.

N. B. In the following kinds and applications of oil painting, we are to hold those proportions in our eye.

§ 4. *Painting in Simple Oil.*

31 Of doors, windows, and window-shutters.

On doors and windows give a layer of ceruse grinded in oil of walnuts diluted in the same oil, together with a little siccative; then give another layer of the same preparation; to which, if you want a grayish colour, add a little black of charcoal and Prussian blue, grinded also in oil of walnuts. If to these you incline to add a third layer, grind and dilute it in pure walnut oil; observing that the two last layers be less clear, or have less oil in them, than the first; the colour in this case is more beautiful and less apt to blister with the sun.

32 Of walls.

Walls that are to be painted must be very dry; and this being supposed, give two or three layers of boiling linseed oil to harden the plaster; then lay on two layers of ceruse or ochre, grinded and diluted in linseed oil; and when these are dry, paint the wall.

33 Of tiles.

To paint tiles of a slate colour, grind separately ceruse and German black in linseed oil; mix them together in the proportion which the colour requires, and dilute them in linseed oil: then give the first layer very clean to prime the tiles; and make the three next layers thicker, to give solidity to the work.

34 Of arbours, &c.

To paint arbours and all kinds of garden work, give a layer of white ceruse grinded in oil of walnuts, and diluted in the same oil, with the addition of a little litharge, then give two layers of green, composed of one pound of verdigris and two pounds of white lead, grinded and diluted in oil of walnuts. N. B. This green is of great service in the country for doors, window shutters, arbours, garden seats, rails, either of wood or iron; and in short for all works exposed to the injuries of the weather.

35 Of statues and vases.

To whiten statues, vases, and all ornaments of stone, either within or without doors; first clean the subject well,

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well, then give one or two layers of white ceruse, grinded and diluted in pure oil of pinks, and finish with giving one or many layers of white lead prepared in the same manner.

36 Painting on the inside of the house.

If you wish to paint on walls not exposed to the air, or on new plaster, give one or two layers of boiling linseed oil, and continue the brush till the walls are fully soaked; then give a layer of white ceruse, grinded in oil of walnuts, and diluted with three-fourths of the same oil and one fourth essence; and lastly, give two layers more of white ceruse, grinded in oil of walnuts, and diluted in oil mixed with essence, if it is not to be varnished; but in pure essence if it is. It is in this manner that walls are painted white. If you adopt another colour, it is necessary to grind and dilute it in the same quantities of oil and essence.

37 Chairs, benches, stone, and plaster.

To paint chairs, benches, stone, or plaster, give a layer of white ceruse grinded in oil of walnuts and diluted in the same oil, into which you have cast a little litharge to make it dry; then apply a layer of the tint you fix on, grinded in oil and diluted in one part oil and three parts essence; and afterwards give two more layers of the same tint grinded in oil and diluted in pure essence: This may be varnished with two layers of spirit of wine.

38 Steel colour for locks.

To make a steel colour, grind separately in essence, white ceruse, Prussian blue, fine lac, and verdigris. The tone which you require is procured by the proper mixture of those ingredients. When you have fixed on the tone of colour, take about the size of a walnut of the ingredients, and dilute them in a small vessel in one part of essence and three parts of white oily varnish. *N. B.* This colour is generally made of white ceruse, of black charcoal, and Prussian blue, grinded in thick oil, and diluted in essence, which is the cheapest method of procuring it; but the former is the most beautiful.

39 Ballustrades and railings.

For painting ballustrades and railings, dilute lamp black with varnish of vermilion; giving two layers of it, and afterwards two layers of spirit of wine varnish.

40 Wainscotting of apartments.

Since the discovery of oil painting, and the knowledge that wood is preserved by it, and especially since the discovery of a varnish without smell, and which even takes away that of oil, the painting of apartments in oil has been with justice preferred.

In fact the oil stops up the pores of the wood; and although it does not altogether resist the impression of moisture, yet the effect is so little perceptible, that it is to be recommended as the best method of preserving wood.

To preserve wainscotting in the most effectual manner from moisture, it is necessary to paint the wall behind it with two or three layers of common red, grinded and diluted in linseed oil.

To paint the wainscotting itself, give a layer of white ceruse grinded in oil of walnuts, and diluted in the same oil mixed with essence. This layer being dry, give two more of the colour you have adopted, grinded in oil and diluted in pure essence. If you wish the mouldings and sculpture to be painted in a different colour, grind and dilute it in the same manner.

Two or three days after, when the colours are fully dry, give two or three layers of your white varnish without smell, and which also prevents the offensive smell of the oil colours. *N. B.* Those who begin their operations in water colours, if they find it more agreeable, may finish it in oil colours as above.

When the pores of the wood are well stopped by the prepared white, a layer of white ceruse grinded in oil of walnuts, and diluted in the same oil, mixed with essence, may be applied. This will be sufficient, the wood being previously primed; and afterwards lay on your intended colour and varnish.

§ 5. *Painting in Oil with the Polished Varnish.*

This is the best kind of oil painting, owing more to the care it requires than to the proceedings, for they are nearly the same with those of simple oil painting; the difference consisting only in the preparation and manner of finishing.

To paint wainscottings of apartments with the polished varnish, it is necessary, in the first place, that the pannels be new. Then, 41 Wainscottings.

1. Make the surface of the subject which you mean to paint very smooth and level, which is done by a layer, which serves to receive the hard tint or polished ground and the colours.

This layer ought to be of white, whatever colour you are afterwards to apply. It consists of white ceruse, grinded very fine in linseed oil, with a little litharge, and diluted in the same oil mixed with essence.

2. Make the polished ground by seven or eight layers of the hard tint. In painting equipages, a dozen is necessary.

The hard tint is made, by grinding pure white ceruse, which has not been much calcined, very finely in thick oil, and diluting it with essence. You must take care that the layers of the hard tint be not only equal as to the application, but to the quantity of the white ceruse and the oil, and to the degree of calcination. Then,

3. Soften this ground with pumice stone.

4. Polish it moderately with a piece of serge soaked in a pail of water, in which you have put some powder of pumice stone finely grinded and passed through a fine sieve. There is no occasion to spare washing, as this part of the operation will not spoil with water.

5. Choose the tint with which you intend to decorate your apartment; grind it in oil, and dilute it in essence; pass it through a piece of very fine silk, give two or three layers carefully and thinly spread over the surface, as on this part of the operation depends in a great measure the beauty of the colour. All sorts of colours may be employed in this manner in oil of essence.

6. Give two or three layers of a spirit of wine varnish, if it is to wainscotting; if to the body of a coach, a varnish of oil is employed. If the varnish is to be polished, it is necessary to give seven or eight layers at least, laid on equally and with great precaution, not to be thicker in one place than another, which occasions spots.

7. It is again polished with pumice stone reduced to powder, and water and a piece of serge. If the wainscotting has been painted before, it is necessary to rub off the colour till you come to the hard tint, which is done with pumice stone and water, or with a piece of linen dipped in essence.

There is a white painting in oil, called *white varnish polish*, which corresponds to the king's white in water colours, 42 White varnish polish in oil.

Painting in Oil-Colours.

colours, and is equal to the freshness and gloss of marble if it is applied to wood. To paint in this manner,

1. Give a layer of white ceruse grinded in oil of walnuts, with a little calcined copperas, and diluted in essence. But if it is applied to stone, it is necessary to employ oil of walnuts and calcined copperas alone.

2. Grind white ceruse very fine in essence, and dilute it in fine white oil varnish with copal.

3. Give seven or eight layers of it to the subject.—The varnish mixed with the white ceruse dries so promptly, that three layers of it may be given in a day.

4. Soften and polish all the layers as above.

5. Give two or three layers of white lead grinded in oil of walnuts, and diluted in pure essence.

6. Give seven or eight layers of white spirit of wine varnish, and then polish them.

§ 6. *Of Painting in Varnish.*

To paint in varnish, is to employ colours grinded and diluted in varnish, either in spirits of wine or oil, on all sorts of subjects. Wainscotting, furniture, and equipages, are painted in this manner, though we shall confine ourselves to the first.

1. Give two layers of white of Bougival, diluted in a strong size boiling pot.

2. Give a layer of what the French call *de blanc apprit*.

3. Fill up the defects of the wood with mastich in water; and when the layers are dry, smooth them with the pumice stone.

4. When the wood is smooth, suppose the paint a gray colour, take one pound of white ceruse, one dram of Prussian blue, or of black of charcoal or ivory black; put the white into a piece of leather, so tied that the colours cannot escape; shake them till they are sufficiently mixed.

5. Put two ounces of colours into a quartern of varnish; mix them carefully; give one layer above the white.

6. This layer being dry, put one ounce of colours into the same quantity of varnish as above, and give a second layer.

7. To the third layer give half an ounce of colour to the same quantity of varnish.

8. As each of these layers dry, be careful to rub them with a piece of new coarse cloth, in such a manner, however, as not to injure the colour. *N. B.* The three layers may be given in one day.

9. If you want to give a perfect lustre, add a fourth layer prepared as the third.

All other colours, as blue, &c. may be applied in the same manner. This method is the only one by which orpiment can be employed in all its beauty, but not without some of its inconveniences.

Another manner of performing this kind of work, is to apply the colours and the varnish without previously using the size and the white ground. This is extremely expeditious, but it is easy to perceive it will want the polish and brilliancy of the other.

Sect. IV.

We cannot perhaps more properly conclude this article, than with an account of M. de Morveau's attempts to render more perfect the proportion of colours, and especially of *white*, employed in painting. These we shall extract from a memoir of his read in the academy of Dijon.

"White (says the ingenious academician) is the most important of all colours in painting. It affords to the painter the materials of light, which he distributes in such a manner as to bring his objects together, to give them relief, and that magic which is the glory of his art. For these reasons I shall confine my attention at present to this colour.

43 Examination of known whites.

"The first white which was discovered, and indeed the only one yet known, is extracted from the calx of lead. The danger of the process, and the dreadful distemper with which those employed in it are often seized, have not yet led to the discovery of any other white. Less anxious, indeed, about the danger of the artist than the perfection of the art, they have varied the preparation, to render the colour less liable to change. Hence the different kinds of white, viz. white of Crems in Austria, white lead in shells, and white ceruse. But every person conversant in colours, knows that the foundation of all these is the calx of lead, more or less pure, or more or less loaded with gas. That they all participate of this metallic substance, will indeed appear evident from the following experiment, which determines and demonstrates the alterability of colours by the phlogistic vapour.

"I poured into a large glass bottle a quantity of liver of sulphur on a basis of alkali, fixed or volatile, it makes no difference; I added some drops of distilled vinegar, and I covered the mouth of the bottle with a piece of pasteboard cut to its size, on which I disposed different samples of crems, of white lead, and of ceruse, either in oil or in water; I placed another ring of pasteboard, over the first, and tied above all a piece of bladder round the neck of the bottle with a strong pack-thread. It is evident, that in this operation I took advantage of the means which chemistry offers to produce a great quantity of phlogistic vapour, to accomplish instantaneously the effect of many years; and, in a word, to apply to the colours the very same vapours to which the picture is necessarily exposed, only more accumulated and more concentrated. I say the same vapour, for it is now fully established, that the smoke of candles, animal exhalations of all kinds, alkalescent odours, the electric effluvia, and even light, furnish continually a quantity more or less of matter, not only analogous, but identically the same with the vapour of vitriolic acid mixed with sulphur.

"If it happens that the samples of colours are sensibly altered by the phlogistic vapour, then we may conclude with certainty, that the materials of which the colours are composed, bear a great affinity to that vapour; and since it is not possible to preserve them entirely from it in any situation, that they will be more or less affected with it, according to the time and a variety of circumstances.

"After some minutes continuance in this vapour, I examined the samples of colours submitted to its influence, and found them wholly altered. The ceruse and the white lead both in water and oil were changed into black; and the white of crems into a brownish black; and hence those colours are bad, and ought to be abandoned. They may indeed be defended in some measure by varnish: but this only retards for a time the contact of of the phlogistic vapour; for as the varnish loses its humidity, it opens an infinite number of passages to this subtile fluid.

"After having ascertained the instability of the whites in common use, I made several attempts to discover such as would prove more lasting; and though many of these attempts were without effect, I shall give a succinct account of the whole, which may save a great deal of trouble to those who wish to travel over the same field.

"There are three conditions essential to a good colour in painting.

"*First*, That it dilute easily, and take a body both with oils and with mucilages, or at least with the one or other of these substances, a circumstance which depends on a certain degree of affinity. Where this affinity is too strong, a dissolution ensues; the colour is extinguished in the new composition, and the mass becomes more or less transparent; or else the sudden reaction absorbs the fluid, and leaves only a dry substance, which can never again be softened. But if the affinity is too weak, the particles of colour are scarcely suspended in the fluid, and they appear on the canvass like sand, which nothing can fix or unite.

"The *second* condition is, That the materials of which colours are composed do not bear too near an affinity with the phlogistic vapour. The experiments to which I submitted whites from lead, is an infallible means of ascertaining the quality of colours in this respect, without waiting for the slow impression of time.

"A *third* condition equally essential is, That the colouring body be not volatile, that it be not connected with a substance of a weak texture, susceptible of a spontaneous degeneracy. This consideration excludes the greater part of substances which have received their tint from vegetable organization; at least it makes it impossible to incorporate their finer parts with a combination more solid.

"After these reflections, my researches were directed, first, to the five pure earths; next, to the earthy compounds; in the third place, to the earthy salts, which can scarcely be dissolved; lastly, to the metallic earths, either pure or precipitated by Prussian alkali. M. Wenzel has discovered a sixth earth, which I call *eburne*, and which, after other experiments, I thought of applying to the purposes of painting; but I soon perceived that it would have the same fault with other kinds of earth, and, besides, that it could not be obtained but at a very considerable expence.

"The five pure earths possess fixity in a very great degree, and at the same time are little affected by the phlogistic vapour; but they refuse to unite with oil or mucilages, and the white is totally extinguished when they are grinded with these liquids. I made several attempts on earth from alum, not only because M. Beaumé recommended the use of it in painting, and because it enters into the composition of Prussian blue, but also because it is a chief ingredient in ochres, and other earths of that nature, which supposes that it should unite in a certain degree with diluting liquors; notwithstanding, in whatever manner I treated it, it would not yield a white; but one will be less surprised at this want of success, when he considers, that in the ochres and Prussian blue, the earth from alum is only the vehicle of the colouring body, whereas here it is the colour itself.

"To be convinced of the truth of this observation, it is only necessary to mix equal parts of this earth, or even of clay not coloured, with ceruse or any other white: the mixture will be susceptible of being grinded in oil or in gum without being extinguished; it will easily unite with any coloured substance, and be productive of no bad consequences to the pure earths.

"Nature and art present to us a considerable number of earthy compositions sufficiently white for the purposes of painting; such as the jasper white, the feldspar white, the schirl white, &c. But all these substances, in all the trials which I made, had the fault which I have already mentioned; and originating from the same cause, they wanted a fixed colouring body, which would not change when it is pulverized, nor be extinguished when it is diluted.

"The ultramarine blue, which is extracted from the blue jasper, and known by the name of lapis lazuli, seems at first view to warrant the possibility of appropriating to painting all the opaque half vitrified compositions of the nature of jasper.

"Prepossessed with this idea, I conceived the hope of producing a true white lapis; but I soon perceived that the experiment confirmed the principle which I had laid down from my observations on pure earths; since it is not the substance peculiar to the jasper which constitutes the ultramarine blue, but the metallic substance which accidentally colours this particular kind of jasper.

"In the same manner, art in this imitation of nature should have for its object to give a permanent base to a colour already formed, to fix it without altering, and to augment perhaps its splendour and its intensity, without attempting to produce a colour.

"In excepting from earthy and metallic salts all those of which the acid is not completely saturated, which would easily attract the humidity of the air, or which would be easily dissolved, you have but a very small number to make experiments on.

"The natural and artificial *selenite* gives with oil a paste without colour, and tasting somewhat like honey; its white is better preserved with a gum, but even in this case it resembles a half transparent pap.

"The natural or regenerated *heavy spar* is the most likely salt to produce white. As it is of all others the most difficult to dissolve, it appears after pulverization to be a very fine white, but is scarcely touched with oil when it becomes gray and half transparent: the mucilage alters it also, although less discernibly; and it does not even resume its white colour after it becomes dry on the canvas.

"The same is the case with *calcareous borax*, formed by the solution of borax in lime water; its white is completely extinguished with oil, less so with gum; but it hardens so instantaneously with the latter, that it is impossible ever to dilute it again.

"Calcareous tartar, obtained by casting quicklime into a boiling solution of cream of tartar, is affected with oil in the same manner as selenite, but with mucilaginous water it gives a pretty good white, only possessed of little reflection, and appearing like plaster; it applied very well to the canvas, and resisted the phlogistic vapour.

"According to M. Weber, in his work entitled *Fabriken und Kunste*, published 1781, the white, called in Germany *krembser wiess*, is nothing but the vitriol of of lead, prepared by dissolving lead in nitrous acid, and precipitating it in vitriolic acid; and forming it afterwards into solid tablets by means of gum water. It is certain that this resembles in no shape the white called in France the white of crems; at least I never found that it could be dissolved in vinegar; but I tried the white prepared in M. Weber's manner, and the result was the same as above, that is to say, it turned completely black.

"The vitriols of lead and of bismuth alter more speedily than the calces of those metals. And thus, with the exception of calcareous tartar, which may be of some use in water colours, the best earthy salts on which I have made experiments, may all, or the most of them, give a base of some colours, but cannot constitute by themselves a colour useful in painting.

"Of the fifteen known metallic substances, there are nine which yield white calces: namely, silver, mercury, lead, tin, antimony, bismuth, zinc, arsenic, and manganese.

"Of these nine substances, we may almost pass over silver and mercury; because, though they yield a very fine white, precipitated by means of crystallized vegetable alkali, yet it is soon altered when exposed to the air; that from silver changing into black, and that from mercury into yellow.

"It is well known that lead gives a very good white, and one which unites easily with oil or size; but that it is extremely liable to change, has been my principal object to prove, and the experiments which I have made place it beyond contradiction.

"I shall only add, that if there is a preparation able to correct this fault, it should be the precipitation of the earth of this metal in its acetous dissolution by Prussian alkali; but the white which results from this preparation becomes sensibly brownish when it is exposed a few minutes only to the phlogistic vapour.

"It would be therefore unreasonable to persevere in the use of this substance, or to wish to render it fixed, since the changes which it undergoes do not alter its nature, and the indestructible order of its affinities.—The calx of tin is easily applied to any purpose, and experiences no change from the concentrated phlogistic vapour. These considerations induced me to endeavour to obtain this calx perfectly white; and here follows the result of my operations: The tin calcined gives a pretty white calx; but whatever attention I paid to take off the red surface which the violence of the fire occasioned, a shade of gray always appears when it is diluted. Tin calcined by nitre in fusion, gives a tarnished and gross calx, which multiplied washings could not deprive of a yellowish tint.

"Having precipitated, by means of crystallized vegetable alkali, a solution of English tin, which had been made in the muriatic acid, after the manner of M. Bayen to extract the arsenic, I had a calx of the greatest whiteness, so light that it buoyed up to the surface of the liquor, and so thin that the greater part of it passed through the filter; but it experienced at the same sime a kind of adherence with the salts, which makes the part of it retained by the filter incapable of being pulverized, gummy, half transparent, and even a little changed into yellow. In this condition it is extinguished when diluted; it is necessary, therefore, to moisten it in boiling water, and afterwards to calcine slightly the sediment after it has had sufficient time to settle.

"I have tried the calcination by means of moisture, in employing the tin of the purest melac, and rectified nitrous acid, according to the method of Meyer. It formed a very white sparkling calx, which remained in the filter in the consistency of jelly.—Meanwhile, I observed that it was always a little yellow by the mixture of a portion of that earth which took, in the operation, the colour of turbith mineral.

"A very fine white calx is extracted from antimony, calcined by nitre in fusion; but the earth of this semi-metal must be placed in the number of those which combine too easily with the phlogistic vapour. The diaphoretic antimony, grinded in oil, took in ten minutes in my phlogistic apparatus a colour somewhat like sulphur.

"The property of bismuth to give a very fine white calx, known by the name of *magistery*, or white fard, is generally known; it is easily prepared, since it is only necessary to dissolve the bismuth in nitrous acid, and to precipitate the solution by pure water: it dilutes perfectly with oil and mucilages. But this colour ought to be rejected, as the most alterable by the phlogistic vapour. It became completely black in ten minutes in my apparatus; and this fact is also proved from what happens to women who use this colour, when they are exposed to the vapours of sulphur, of garlic, or of any putrid substances.

"Zinc furnishes by all the processes of calcination and precipitation a pretty white calx, when it is pure and separated from iron; otherwise the solutions of the vitriol of zinc will become yellow when exposed to the air. I have precipitated those solutions by lime water, by caustic, and effervescent alkalies; I have calcined this semi-metal alone and with nitre; and in all those operations I have obtained an earthy substance of different degrees of whiteness, which, after it was dried and prepared, mixed readily with oil mucilages without losing its colour; and which experienced no sensible change when exposed to the phlogistic vapour.

"These valuable properties, the chief object of my researches, engaged me to multiply my experiments to determine at once the most economical process, and the most advantageous and infallible preparation.—Those attempts have convinced me, that the calcination of this semi-metal alone in a crucible, placed horizontally on the corners of a reveberating furnace, gives the purest, the whitest, and the least reducible calx; and that to make an excellent colour, it is sufficient to separate the parts not burned with water, and grind it with a little of the earth of alum or chalk to give it a body. Zinc precipitated in Prussian alkali, even in distilled vinegar, retains always a shade of yellow, does not unite so well in oil, and takes a demi-transparent consistence like cheese.

"White arsenic extinguishes much less in diluting than one would believe from its saline nature; it preserves its colour best in gum water; and it is remarkable, that instead of turning black in the phlogistic vapour, it takes a very distinct shade of yellow. This property is sufficiently singular and constant to furnish a new method of analysing arsenic, so as to know it. And this alteration of colour makes it of no use in in painting, although its deleterious qualities did not forbid the practice.

"The semi-metal known by the name of *manganese*, gives also a white calx. I had at first great hopes from this colour, as, contrary to all those extracted from the other metals, it became white by the phlogistic vapour. There remained, therefore, but one difficulty to overcome, viz. to separate from the manganese the portion of iron which it usually contained, and which infallibly makes the earth a little yellow. To accomplish this in the cheapest manner, I submitted the black ore of the manganese to a long calcination to render its iron insoluble; I afterwards applied vinegar to it, after the example of M. de la Peyrouse; and in precipitating the dissolution by effervescent alkali, I easily obtained a pure white precipitate. But I soon perceived that the facility with which a colouring body loses its phlogiston, is no less an inconveniency than that of attracting it, and productive of the same alterations.

"The white of manganese became very soon yellow when exposed to the air; and this is not to be ascribed to the iron contained in it, since neither the galls nor Prussian alkali had discovered any of it in the dissolution. This substance, therefore, can be of no use in producing a white colour for painting."

The experiment by which M. de Morveau tried the colours not alterable by the phlogistic vapour, was performed before the academy, the prince of Condé being president. "I placed (says he) in my apparatus pieces of cloth, on which were laid the white of calcareous tartar in water, different preparations of white from tin and zinc, in oil and water; and I allowed them to continue exposed to the phlogistic vapour during a sitting of the academy: if they were not altered, their superiority over the whites in use would be sufficiently established. The sitting continued for near an hour; and the bottle having been opened, all the colours continued to have the same shade which they had before. I can, therefore, recommend to painters those three whites, and particularly that of zinc, the preparation of which is exposed to less variation, the shade more lively and uniform, and moreover it is fit for all purposes, and perhaps procured at less expence.

"I will assert farther, that it may be procured in sufficient quantities to supply the place of ceruse in every branch of the art, even in interior house painting:—I would recommend it, less with the view of adding new splendour to this kind of ornament, than for the safety of those who are employed in it, and perhaps for the safety of those who inhabit houses ornamented in this manner.

"But, without being too sanguine, although the processes in the fabrication be simplified in proportion to the demand, as is usually the case, yet there is reason to apprehend that the low price of ceruse will always give it the preference in house-painting. With regard to those who apply colours to nobler purposes, they will not hesitate to employ the white of zinc. I am assured that four franks is paid for the pound of the white of crems; and I believe the white in question, prepared in the manner which I have pointed out, might be sold for six.

"M. Courtors, connected with the laboratory of the academy, has already declared that it is used for house-painting: less, however, in regard to its unalterability, than to its solubility: and this can be the more readily believed, as the flower of zinc enters into many compositions of the apothecary. The same M. Courtors has arrived at the art of giving more body to this white, which the painters seemed to desire, and also of making it bear a comparison with white lead either in water or oil. The only fault found with it, is its drying slowly when used in oil; but some experiments which I have made, incline me to believe that this fault may be easily remedied, or at least greatly corrected, by giving it more body. At any rate, it may be rendered siccative at pleasure, by adding a little vitriol of zinc or copperas slightly calcined.

"Painters already know the properties of this salt, but perhaps they do not know that it mixes with the white of zinc better than with any other colour; the reason is, they have chemically the same base. It is prepared by purging the white copperas of that small portion of iron which would render it yellow; and this is easily done in digesting its solution, even when cold, on the filings of zinc.

"The mixture of this salt thus prepared is made on the pallet, without producing any alteration, and a small quantity will produce a great effect."

APPENDIX.

We shall here add an account of some processes which have been recommended, on account of their cheapness, for preparing different materials for economical painting. The first is a method of house painting with milk, by Cadet de Vaux *. The following are the directions for preparing this paint.

* Nich. Jour. v. 248. 4to.

"Take of skimmed milk a pint, which makes two pints of Paris, or nearly two quarts English; fresh slaked lime, six ounces, (about six and a half ounces avoirdupois; oil of caraways, or linseed, or nut, four ounces; Spanish white (whiting) three pounds: put the lime into a stone-ware vessel, and pour upon it a sufficient quantity of milk to make a mixture resembling thin cream; then add the oil a little at a time, stirring it with a small spatula; the remainder of the milk is then to be added, and lastly, the Spanish white. Skimmed milk in summer is often clotted, but this is a circumstance of no consequence to our object, because the contact with the lime soon restores its fluidity. But it must on no account be sour, because in that case it would form with the lime a kind of calcareous acetite, capable of attracting moisture.

"The lime is slaked by dipping it in water, out of which it is to be immediately taken, and left to fall in pieces in the air.

"The choice of either of these oils is indifferent; nevertheless for white paint the oil of caraways is to be preferred, because colourless. The commonest oils may be used for painting with the ochres.

"The oil when mixed in with the milk and lime disappears, and is totally dissolved by the lime, with which it forms a calcareous soap.

"The Spanish white is to be crumbled, or gently spread on the surface of the fluid, which it gradually imbibes, and at last sinks; at this period it must be well stirred in. This paint may be coloured like distemper (or size colour) with levigated charcoal, yellow ochre, &c.

"And

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"And it is used in the same manner:

"The quantity here prescribed is sufficient for the first coat of six toises, or 27 square yards English.

"The price of this quantity amounts to nine sols, which reduces the price of the square toise to one sol, six deniers, prime cost."

And to give this paint a greater degree of solidity, that it may be employed as a substitute for oil paint, the author adds to the proportions of the paint for out-door works, of slaked lime, oil, white Burgundy pitch, each two ounces. The pitch is to be melted with a gentle heat in the oil, and then added to the smooth mixture of the milk and lime. In cold weather this mixture is to be warmed, that it may not occasion too speedy cooling of the pitch, and to facilitate its union with the milk of lime. This paint, it is said, has some analogy with that known by the name of *encaustic*. It has been employed, the author informs us, for outside shutters, formerly painted with oil, and is preferable to painting with lead, objects that are exposed to putrid exhalations, which are apt to blacken paint composed of metallic matters, especially of lead.

A method has been proposed by Mr Vanherman, for making cheap and durable paints with fish oil. The paints thus prepared, beside their cheapness, are not subject to blister or peel off by exposure to the weather. They may be manufactured of any colour, and laid on by ordinary labourers. The price of some of them is so low as twopence, and the highest does not exceed threepence per pound, in a state fit for use. The author adds, that white lead ground with prepared fish oil, and thinned with linseed oil, surpasses any white hitherto employed for resisting all weathers, and retaining its whiteness. The following is an account of his processes †.

† *Transact. of the Society for Arts*, &c. vol. xxiii.

"*To refine one Ton of Cod, Whale, or Seal Oil, for painting, with the cost attending it.*

One ton of fish oil, or 252 gallons,	L.36	0	0
32 gallons of vinegar, at 2s. per gallon,	3	4	0
12 lbs. litharge, at 5d. per lb.	0	5	0
12 lbs. white copperas, at 6d. ditto,	0	6	0
12 gallons of linseed oil, at 4s. 6d. per gallon,	2	14	0
2 gallons of spirits of turpentine, at 8s. ditto,	0	16	0
	L.43	5	0

252 gallons of fish oil,
12 ditto linseed oil,
2 ditto spirits of turpentine,
32 ditto vinegar.

298 gallons, worth 4s. 6d. per gallon.

Which produces	L.67	1	0
Deduct the expence	43	5	0
	L.23	16	0 profit.

"*To prepare the Vinegar for the Oil.*

"Into a cask which will contain about forty gallons, put 32 gallons of good common vinegar; add to this 12 pounds of litharge, and 12 pounds of white copperas in powder; bung up the vessel, and shake and roll it well twice a-day for a week; when it will be fit to put into a ton of whale, cod, or seal oil; (but the Southern whale oil is to be preferred, on account of its good colour, and little or no smell); shake and mix altogether, when it may settle until the next day; then pour off the clear, which will be about seven eighths of the whole. To this clear part add twelve gallons of linseed oil, and two gallons of spirit of turpentine; shake them well together, and after the whole has settled two or three days, it will be fit to grind white lead, and all fine colours in; and, when ground, cannot be distinguished from those ground in linseed oil, unless by the superiority of its colour.

"If the oil is wanted only for coarse purposes, the linseed oil and oil of turpentine may be added at the same time that the prepared vinegar is put in, and after being well shaken up, is fit for immediate use without being suffered to settle.

"The vinegar is to dissolve the litharge; and the copperas accelerates the dissolution, and strengthens the drying quality.

"The residue, or bottom, when settled, by the addition of half its quantity of fresh lime-water, forms an excellent oil for mixing with all the coarse paints for preserving outside work.

"*Note.* All colours ground in the above oil, and used for inside work, must be thinned with linseed oil and oil of turpentine.

"*** The oil mixed with lime-water, I call *incorporated oil.*

"*The method of preparing, and the expence of the various Impenetrable Paints.*

"First,—*Subdued Green.*

Fresh lime water, 6 gallons,	L.0	0	3
Road dirt finely sifted, 112 pounds,	0	1	0
Whiting, 112 ditto,	0	2	4
Blue-black, 30 ditto,	0	2	6
Wet blue, 20 ditto,	0	10	0
Residue of the oil, 3 gallons,	0	6	0
Yellow ochre in powder, 24 pounds,	0	2	0
	L.1	4	1

"This composition will weigh 368 pounds, which is scarcely one penny per pound. To render the above paint fit for use, to every eight pounds add one quart of the incorporated oil, and one quart of linseed oil, and it will be found a paint with every requisite quality, both of beauty, durability, and cheapness, and in this state of preparation does not exceed twopence halfpenny per pound; whereas the coal tar of the same colour is sixpence."

To this we shall only add the following receipt for a constant white for inside painting. This paint, the author observes, is not entirely free from smell in the operation, but becomes dry in four hours, at the end of which time the smell is entirely dissipated.

"*White Paint.*

"To one gallon of spirits of turpentine, add two pounds of frankincense; let it simmer over a clear fire until dissolved; strain it and bottle it for use. To one gallon

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gallon of my bleached linseed oil, add one quart of the above, shake them well together and bottle it also. Let any quantity of white lead be ground with spirits of turpentine very fine; then add a sufficient portion of the last mixture to it, until you find it fit for laying on. If in working it grows thick, it must be thinned with spirits of turpentine.—It is a flat or dead white."

Pair, Pairing.

PAIR; two of a sort, a couple.

PAIRING, the uniting or joining in couples.

The instinct of pairing is bestowed on every species of animals to which it is necessary for rearing their young; and on no other species. All wild birds pair; but with a remarkable difference between such as place their nests on trees and such as place them on the ground. The young of the former, being hatched blind, and without feathers, require the nursing care of both parents till they be able to fly. The male feeds his mate on the nest, and cheers her with a song. As soon as the young are hatched, singing yields to a more necessary occupation, that of providing food for a numerous issue; a task that requires both parents.

Eagles and other birds of prey build on trees, or on other inaccessible spots. They not only pair, but continue in pairs all the year round; and the same pair procreates year after year. This at least is the case of eagles: the male and female hunt together, unless during incubation, at which time the female is fed by the male. A greater number than a single pair are never seen in company.

Kames's Sketches, vol. i. 198.

Gregarious birds pair, in order probably to prevent discord in a society confined to a narrow space. This is the case particularly of pigeons and rooks. The male and female sit on the eggs alternately, and divide the care of feeding their young.

Partridges, plovers, pheasants, sea fowl, grouse, and other kinds that place their nests on the ground, have the instinct of pairing; but differ from such as build on trees in the following particular, that after the female is impregnated, she completes her task without needing any help from the male. Retiring from him, she chooses a safe spot for her nest, where she can find plenty of worms and grass seed at hand; and her young, as soon as hatched, take foot, and seek food for themselves. The only remaining duty incumbent on the dam is, to lead them to proper places for food, and to call them together when danger impends. Some males, provoked at the desertion of their mates, break the eggs if they stumble on them. Eider ducks pair like other birds that place their nests on the ground; and the female finishes her nest with down plucked from her own breast. If the nest be destroyed for the down, which is remarkably warm and elastic, she makes another nest as before. If she is robbed a second time, she makes a third nest; but the male furnishes the down. A lady of spirit observed, that the eider duck may give lesson to many a married woman, who is more disposed to pluck her husband than herself. The black game never pair: in spring, the cock on an eminence crows, and claps his wings; and all the females within hearing instantly resort to him.

Pairing birds, excepting those of prey, flock together in February, in order to choose their mates. They soon disperse; and are not seen afterward but in pairs.

Pairing, Paisley.

Pairing is unknown to quadrupeds that feed on grass. To such it would be useless; as the female gives suck to her young while she herself is feeding. If M. Buffon deserves credit, the roe deer are an exception. They pair, though they feed on grass, and have but one litter in a year.

Beasts of prey, such as lions, tigers, wolves, pair not. The female is left to shift for herself and for her young; which is a laborious task, and often so unsuccessful as to shorten the life of many of them. Pairing is essential to birds of prey, because incubation leaves the female no sufficient time to hunt for food. Pairing is not necessary to beasts of prey, because their young can bear a long fast. Add another reason, that they would multiply so fast by pairing, as to prove troublesome neighbours to the human race.

Among animals that pair not, males fight desperately about a female. Such a battle among horned cattle is finely described by Lucretius. Nor is it unusual for seven or eight lions to wage bloody war for a single female.

The same reason that makes pairing necessary for gregarious birds, obtains with respect to gregarious quadrupeds; those especially who store up food for winter, and during that season live in common. Discord among such would be attended with worse consequences than even among lions and bulls, who are not confined to one place. The beavers, with respect to pairing, resemble birds that place their nests on the ground. As soon as the young are produced, the males abandon their stock of food to their mates, and live at large; but return frequently to visit them while they are suckling their young.

Hedgehogs pair, as well as several of the monkey kind. We are not well acquainted with the natural history of these animals; but it would appear that the young require the nursing care of both parents.

Seals have a singular economy. Polygamy seems to be a law of nature among them, as a male associates with several females. The sea turtle has no occasion to pair, as the female concludes her task by laying her eggs in the sand. The young are hatched by the sun, and immediately crawl to the sea.

PAISLEY, a town of Renfrewshire, in Scotland, situated about six miles and a half west of Glasgow, on the river White Cart, over which there are two stone bridges of two arches each, and one which consists of three arches. The town is very ancient; but was of much less consequence formerly than it is at present. "No satisfactory etymology has hitherto occurred of the name *Paisley*. The following has been suggested by a good Gaelic scholar: 'A ridge of rocks that runs across the river, and forms a beautiful cascade, would, prior to the building

Statistical Account of Scotland, vol. vii.

Paisley. building of the town, be undoubtedly the most striking object that this place would present. The brow or face of a rock is in Gaelic *Pais-licht*. A church in front of the rock would be the church in *Pais-licht*. A church did stand here previous to 1160: it is named in the foundation charter *Ecclesia de Paselet*, Latinized, in the records of the monastery, *Paslatum*, an easy derivative from *Pais-licht*, in all probability the original of the modern *Paisley*. It was erected into a burgh of barony by James IV. in the year 1488, at that time probably deriving all its importance from the rich monastery which had been established there for several ages; for George Schaw, who was then abbot of the monastery, obtained this privilege from the king. Even in Mr Crawford's time, who wrote the history of the shire of Renfrew near the beginning of the 18th century, it seems to have been but an inconsiderable place; for he describes it as consisting only of one principal street, about half a mile in length, with several lanes belonging to it; whereas now the town, with its suburbs, occupies such an extent of ground, that strangers are apt to consider it as, next to Edinburgh and Glasgow, the largest and most populous town in Scotland. Its buildings of late years have been greatly improved; its streets are well paved; and the different parts of the town and suburbs, where the river intervenes, are connected with one another by three bridges at convenient distances."

The affairs of the community are managed by three bailies, of which the eldest is commonly in the commission of the peace, a treasurer, a town clerk, and 17 counsellors, who are annually elected upon the first Monday after Michaelmas. It enjoys all the powers necessary for government and police, without any of the burdens to which royal boroughs are subject. The freedom of the place is conferred on very moderate terms. The revenues of the town are not great, but they have been managed to the best advantage. The rapid increase of the place has not been attended with a proportional increase of revenue; therefore several necessary improvements, and intended public buildings, are not yet carried into execution. It gives the title of baron to the earls of Abercorn; the first of whom was a younger son of the Duc de Chatelherault. The *black book of Paisley*, frequently mentioned in Scottish history, was a chronicle of the public affairs and remarkable events, kept by the monks who resided in the monastery. It agreed in every material fact with the *Scoti Chronicon* of Fordun; and is by many thought to be the same performance.

The old part of the town runs from east to west upon the south slope of a ridge of hills, from which there is a fine prospect of the city of Glasgow and the adjacent country; but to the southward, the view terminates in a ridge of green hills, about two miles distant. Including the late buildings and suburbs, it is fully a mile long, and nearly as much in breadth. On the east side of the river Cart, stand the abbey and new town. This new town was some years ago feued off by the earl of Abercorn, and now consists of a number of handsome buildings. The streets are laid off in a regular manner, but (rather unfortunately for the conveniency and elegance of some of the houses) not in right angles. Here the earl of Abercorn has built at his own expence one of the largest, most commodious, and most elegant inns in Scotland. In the vicinity of it was proposed also to build several convenient and necessary market places. A little way south of the inn stands the abbey church, the only one which Paisley formerly required. This church, when entire, has been a most noble building, and consisted of several distinct and separate places of worship; what now remains of this magnificent Gothic structure is not yet unworthy the notice of the curious in antiquities. Mr Pennant says, the great north window is a noble ruin, the arch very lofty, the middle pillar wonderfully light, and still entire: only the chancel now remains, which is divided into a middle and two side aisles, by very lofty pillars, with Gothic arches; above these is another range of pillars much larger, being the segment of a circle, and above a row of arched niches from end to end, over which the roof ends in a sharp point. The outside of the building is decorated with a profusion of ornaments, especially the great west and north doors, than which scarce any thing lighter or richer can be imagined.

The town of Paisley continued a part of the original or Abbey parish of Paisley till the year 1738; when the magistrates and council having purchased the right of patronage from the then earl of Dundonald, a new church was built, and the town was erected into a separate parish. This is called the *Laigh Church*, is built in the form of a Greek cross, very well laid out, and capable of containing a great number of people. In 1756 another church was built, upon a very extended plan, to accommodate its multiplied inhabitants; in which, though it is one of the largest in Scotland, yet the most distant of the congregation can hear a tolerably good speaker with ease and distinctness; and as it stands upon the highest part of the town, it was afterwards ornamented with a lofty and well-proportioned spire, visible at a great distance. This is called the *High Church*, and is a very fine building: it is an oblong square of 82 feet by 62 within the walls, built of free stone well smoothed, having rustic corners and an elegant stone cornice at the top. In the construction of the roof (which is a pavilion covered with slate, having a platform covered with lead on the top), there is something very curious, and it is admired by every person of taste. In 1781, the number of the inhabitants still rapidly increasing, another church, called the *Middle Church*, was built, not quite so large as the former, but very handsomely and elegantly finished: and in the following year, the town was divided and erected into three separate parishes, exclusive of the Abbey parish, and named according to their respective churches.

There are two large dissenting congregations in the town; those of the Antiburgher persuasion and the Relief. The first of these has existed there for upwards of 30 years; the other is of a late date. There is besides a small congregation of Cameronians.

The townhouse is a very handsome building of cut stone, with a tall spire and a clock. The flesh market has a genteel front of cut stone, and is one of the neatest and most commodious of the kind in Britain. Butchers meat, butter, cheese, fish, wool, and several other articles, are sold here by what they call the tron pound, of 22 English ounces and a half.

The poors house is a large building, very well laid out; and stands opposite to the quay, in a fine free air. It is supported by a small tax taid upon the inhabitants quarterly.

Close by the Abbey church is the earl of Abercorn's burial

Paisley. burial place, the greatest curiosity in Paisley. It is a vaulted Gothic chapel, without pulpit, pew, or any other ornament, but has the finest *echo* perhaps in the world. When the end door (the only one it has) is shut, the noise is equal to a loud and not very distant clap of thunder. If you strike a single note of music, you have the sound gradually ascending, with a great number of repetitions, till it dies away as if at an immense distance, and all the while diffusing itself through the circumambient air. If a good voice sings, or a musical instrument is well played upon, the effect is inexpressibly agreeable. The *deepest*, as well as the most *acute tones*, are distinctly reverberated, and these in regular intervals of time. When a musical instrument is sounded, it has the effect of a number of instruments of a like size and kind playing in concert. When a number of different instruments in unison sound the same note, a good ear is able to distinguish the variety of sound produced by each. A single instrument sounding a particular note, and then instantly its fifth, or any other concordant note, the two sounds can be heard, as it were, running into and uniting with each other in a manner peculiarly agreeable. But the effect of a variety of instruments playing in concert is particularly charming, and must excite such emotions in the soul as it is impossible to describe. In this chapel is the monument of Marjory Bruce (A); she was daughter of Robert Bruce, and wife of Walter, great steward of Scotland, and mother of Robert II. In this same chapel were interred Elizabeth Muir and Euphemia Ross, both consorts to Robert II.

A particular account of the abbey of Paisley would fill many pages. It was founded as a priory for monks of the order of Clugni about the year 1160 by Walter, great steward of Scotland. It was afterwards raised to the rank of an abbacy; and the lands belonging to it were by Robert II. erected into a regality, under the jurisdiction of the abbot. After the Reformation, the abbacy was secularized by the pope in favour of Lord Claud Hamilton, third son of the duke of Chatelherault, in reward of his steady adherence to the cause of Queen Mary; and, in 1588, it was by the king and parliament erected into a temporal lordship, and Lord Claud was created Lord Paisley. The revenues of the abbacy were very considerable: They consisted of the tythes of 28 different parishes, with the property of the lordships of Paisley, of Kilpatrick in Dumbartonshire, and of Monkton in Ayrshire, extending each to a hundred merkland; and the forty pound land of Glen in Lochwinnoch; with the lands of Achengowm, Grange, &c. and a considerable detached property in different parts of the kingdom. All this property, with the patronage of the several churches, fell to Lord Claud Hamilton, last abbot of Paisley. It continued in that family till 1563, when his grandson James earl of Abercorn sold the lordship of Paisley to the earl of Angus, who next year sold it to William Lord Cochran, Kilpatrick to Sir John Hamiltoun of Orbistoun, Monktoun to Lord Bargenny, and Glen to Lord Semple and others. Great part of the lordship of Paisley was at different times sold off by the family of Dundonald; and what remained of it was in 1764 repurchased by the late earl of Abercorn. The fabric of the abbey owed much of its magnificence to Abbot George Schaw, who about 1484 enlarged and beautified the building, surrounding the church, the precincts of the convent, the gardens, and a small deer park, with a noble wall of hewn freestone. The abbey was, after the Reformation, successively the seat of the earls of Abercorn and Dundonald. The late earl of Dundonald demolished the ancient gateway; and, by feuing off the immediately adjoining grounds for building, entirely changed the appearance of the place. As it was thus rendered totally unfit for a family residence, it has since that time been let out into separate dwellings, and is now in a very mean and almost ruinous state. The wall stood almost entire till 1781, when the garden being feued off for building upon by the late earl of Abercorn, the wall was sold to the feuers, and the stones of it employed in their houses.

The vestiges of the Roman camp and *prætorium*, at the west end of the town, are at present almost annihilated. It was supposed to be vaulted underneath.

The number of inhabitants in the town of Paisley amounted in 1695 to 2200; in 1755 they were 4290; in 1782, 11,100; and in 1792, 13,800. In 1801, 17,026; in 1811, 19,937; but including the abbey parish, the whole population was 36,722.

Paisley is now the first manufacturing town in Scotland, and is greatly celebrated on account of some of its branches. The manufactory of silk gauze, in this respect, first claims our notice. This branch is brought here to the utmost perfection, and is wrought to an amazing variety of patterns. It has been computed, that there have been no less than 5000 weavers employed in Paisley and in the country adjacent; and the number of winders, warpers, clippers, and others necessary in other parts of the silk manufacture, has been likewise computed to be no less than 5000. Each loom will produce in an average value 70l. yearly; the whole will then be 350,000l.

It appears, from the best calculation that could be made, that in the year 1784 the manufactures of Paisley in silk gauze, lawn and linen gauze, and white sewing thread (B), amounted to the value of 579,185l. 16s. 6d. and that no fewer than 26,484 persons were employed in carrying them on. It is difficult to give an exact account of the state of its manufactures at present. The silk branch has evidently declined, but the muslin has so far

(A) Her story is singular: In the year 1317, when she was big with child, she broke her neck in hunting near this place; the Cæsarean operation was instantly performed, and the child taken out alive; but the operator chancing to hurt one eye with his instrument, occasioned the blemish that gave him afterwards the epithet of *Blear-eye;* and the monument is also styled that of *Queen Bleary*. Elizabeth Muir died before the accession of her husband Robert.

(B) This was introduced into this town about 60 or 70 years ago. The method of making what is called *glazed white thread*, has been discovered and brought to as great perfection as that made by Mr Leland and Son, London. The value of this branch is computed at about 60,000l. annually.

Paisley.

far come in its room, and the thread manufacture has considerably increased. There is, however, reason to conclude, that, though it is daily advancing, it has not yet recovered its former greatness. Besides these principal manufactures, there are some others carried on there of too much importance to be overlooked: for instance, considerable tan works, four in number, two soap and candle works, a manufacture of ribbons, and another of inkle or tape. In 1789 the annual value of all the manufactures in Paisley of every sort amounted to 660,385l. 16s.

In the various weaving branches there were employed at Whitsunday 1791, in the suburbs of Paisley, 1108 looms, which, added to 2494 employed in the town, gives 3602 in all. But it is to be observed, that the extent to which the weaving branches are carried on by the manufacturers in Paisley, is not to be judged of from the number of looms in the town and suburbs. Besides about 150 in the country part of the parish, there are great numbers employed by them in the villages of Neilstoun, Barhead, Beith, Dalry, Kilwinning, &c. &c. In 1744, when all the business was confined to the town and suburbs, there were 867 looms at work. —The thread-making in Abbey parish employs 9 mills, which, added to 128 employed in Paisley, makes 137 in all. The number in 1744 was 93. The spinning of cotton was introduced into Abbey parish in 1783. The principal seat of that manufactory is at Johnstoun, a neat and regularly built village about three miles west from Paisley, upon the estate of Mr Houston of Johnstoun. The feuing of that village was begun in 1782; and it contained, at Whitsunday 1792, 293 families, or 1434 souls. There are five companies established in it for cotton spinning. Two of these carry on their principal operations by water machinery. In the two mills employed in them, there are going at present 11,672 spindles; but, when the whole machinery in both shall be completed, there will be 22,572. The number of persons, young and old, at present employed in both mills is 660. There is also in the neighbourhood of Paisley a calico printing work. Copperas has been long manufactured at Lord Glasgow's coal works; and for several years past the manufacture of alum has been conducted on a very extensive scale at the same place.

The bleaching business in the Abbey parish is carried on to a very considerable extent. There are 10 fields for whitening muslins and lawns, and about as many for thread, almost wholly employed by the manufacturers in Paisley. About 300 persons are at work in this branch of business, of whom about 240 are women, who are hired for the season. A soap and candle manufacture pays about 2000l. of duty per annum to government, and has in some years paid upwards of 3000l. A black and hard soap manufacture, 4500l. per annum. The starch manufacture is but lately established. The distillery business is to be mentioned under this head: it has for some time past been carried on to a great extent, and the spirit manufactured in great perfection. A considerable quantity of it is exported, but too much of it is consumed at home (c).

Paisley ‖ Paix.

The river on which Paisley stands runs from south to north; and falls into the Clyde, after it has joined the conflux of the rivers Grife and Black Cart at Inchinnan bridge, about three miles below the town. At spring tides, vessels of 40 tons burden come up to the quay. The communication by water is of great importance to the inhabitants: for in this way they are frequently supplied with fish of different kinds, and can send their goods and manufactures to Port Glasgow and Greenock, and to Glasgow likewise; and now, by means of the great canal, they have also a communication with the frith of Forth.

The air here is moist; a necessary consequence of the prevailing south-west winds, which, coming loaded with vapour from the Atlantic, produce frequent and heavy rains. The effects of this moist atmosphere appear in rheumatisms, quinseys, pneumatic ailments, and all the tribe of inflammatory disorders. Upon the whole, however, neither the town nor country adjacent can be said to be unhealthy. Contagions, indeed, at times visit this as other places, which run their usual course as epidemics; but none are remembered of any uncommon violence except a pleurisy in summer 1771, and which, contrary to the received opinion, was truly epidemic. There are no disorders that can be said to be endemic, unless scrofula is to be excepted, which is still but too common. This has been ascribed to the water used by the inhabitants of Paisley: It more probably proceeded from, and certainly was greatly aggravated by, poor living, and by the damp shops which were necessary for the linen manufacture; for since silk weaving became the general employment, and increase of trade has introduced better living, this disorder is less frequent. From the same causes probably it is that swelled and sore legs, once extremely common here, are now but rarely met with. Dysentery raged with great violence in 1765; since that time it has been scarcely complained of. Nervous fevers at times appear; but they are neither very general nor uncommonly fatal. It is to be apprehended, that the confinement and sedentary posture of the weaver, and the laborious life of the bleacher, are frequent causes of consumptive complaints. Intermittents, which, from the damp air, and adjoining moss, might be expected to be common, are not so much as known. W. Long. 4. 20. N. Lat. 55. 52.

PAITA, a sea-port of America, in Peru, and in the audience of Quito. The town consists of about 200 houses but one story high; and the walls are made of split cane and mud, and the roofs only a covering of leaves. The only defence of Paita is a fort without either ditch or outwork; but it is surrounded by a brick wall of little or no strength, on which are mounted eight pieces of cannon. It was frequently plundered by the bucaniers; and Commodore Anson got possession of its fort in 1741, and took and burnt the town because the governor refused to ransom it. W. Long. 81. 19. S. Lat. 6. 12.

PAIX, or Port Paix, a town on the north coast of the island of Hispaniola, which has a pretty good harbour. W. Long. 72. 55. N. Lat. 19. 58.

PALACE,

(c) Of the capital, and number of persons employed in the manufactures, and of the revenue paid to government from them, it is obvious, that the amount, from numerous circumstances, must be extremely variable.

Palace || Palæmon.

PALACE, PALATIUM, a name generally given to the dwelling houses of kings, princes, and other great personages; and taking different epithets, according to the quality of the inhabitants, as *imperial* palace, *royal* palace, *pontifical* palace, *cardinal* palace, *ducal* palace, *episcopal* palace, &c.

It is customary in China to build palaces in honour of great ancestors. Hu-pi-lay, of the Mogul empire, in the year 1263, built one for his ancestors; and he is the first who borrowed this Chinese custom. Amongst the works of the ancient Egyptians, we have an account, in the Ancient Universal History, of a most magnificent palace in the Upper Egypt, not far from Aswan, the ancient Syene; the ruins whereof are enough to strike a spectator with astonishment. It is as large as a little city, having four avenues of columns, leading to as many porticoes. At each gate, between two pillars of porphyry, stand two gigantic figures of fine black marble, armed with maces. The avenues consist of columns set three and three together, in a triangle, on one pedestal: on the chapiter of each triangle is placed a sphinx and a tomb alternately. Every column is 70 feet high, all of one stone. There are in all the four avenues about 5000 or 6000 of these columns, a great many of which are fallen down.

The first hall of this palace is adorned with pieces of history, which seem as fresh as if the painting had not been long finished. In some places they have represented the hunting of antelopes; in others, feasts, and a great many young children playing with all kinds of animals. From thence you go into other apartments, incrusted with marble, the roof being supported with pillars of porphyry and black marble. Notwithstanding the vast quantity of rubbish, our author made shift to get up to the top of this building, from whence he had a prospect of the ruins of the greatest city that ever had been, as he thought, in the world. He supposes it might be the ancient Thebes; but that city stood much lower.

Lucas, vol. iii.

PALACE-Court. See MARSHALSEA.

PALÆMON, or MELICERTA. See MELICERTA.

PALÆMON, Q. *Rhemmius*, a famous grammarian of Rome, in the reign of Tiberius. He was born of a slave at Vienza. We are told he was first brought up in the business of a weaver: but attending his master's son to school, he used this opportunity to procure knowledge; and acquired so much skill in the common learning, that he obtained his freedom, and became a teacher or preceptor at Rome. His claim to learning cannot be questioned, since he is recorded as a scholar even by Juvenal:

Quis gremio Enceladi doctique Palæmonis affert,
Quantum grammaticus meruit labor? Sat. vii.

He had also an excellent memory, a ready elocution, and could make verses extempore. On account of these qualities, notwithstanding his debauched course of life, which was such that nobody was more unworthy to have the preceptorship of youth, he held the first rank among those of his profession. But his arrogance surpassed his merit: he had the confidence to assert, that learning was born when he was born, and would die when he died; and that Virgil had inserted his name in his Eclogues by a certain prophetic spirit; for that he, Palæmon, would infallibly become one day sole judge and arbiter of all poetry. He was excessively prodigal for the gratification of his voluptuous humour; insomuch that neither the immense sums he gained by teaching, nor the great profit he made, both by cultivating his lands and in the way of traffic, proved a sufficient fund to support his extravagancies. We have only some fragments of his works.

Palæmon || Palæstra.

PALÆOLOGUS, MICHAEL, a very able man who was governor of Asia under the emperor Theodorus Lascaris; and who, by various stratagems and cruelties, procured the empire for himself and his posterity. See CONSTANTINOPLE, from N° 145. to the end of that article.

PALÆPAPHOS (Strabo, Virgil, Pliny), a town of Cyprus, where stood a temple of Venus; and an adjoining town called *Neo Paphos;* where St Paul struck Elymas blind, and converted the proconsul Sergius Paulus.

PALÆSTRA, in Grecian antiquity, a public building where the youth exercised themselves in wrestling, running, playing at quoits, &c. To prevent the combatants from hurting themselves by falling, the bottom of the palæstra was covered with dust or gravel. Some will have the palæstra to be only a part of the gymnasium. Many authors imagine that the palæstra was of two kinds; the one for the exercise of the body, the other for the cultivation of the mind; but the derivation of the word seems to confine it to bodily exercise.

We have this account of the palæstræ in Barthelemi's Anacharsis †: "They are nearly of the same form with the gymnasia. We visited the apartments appropriated to all the species of baths; those where the wrestlers leave their clothes, where they rub their bodies with oil to render their limbs supple, and where they roll themselves in the sand in order to give their antagonists a hold.

† Vol. iii.

"Wrestling, leaping, tennis, and all the exercises of the lyceum, were here repeated before us with greater varieties, and with more strength and skill on the part of the performers. Among the different groups before us we distinguished men of the most perfect beauty, and worthy of serving as models for artists: some with vigorous and boldly marked outlines, as Hercules is represented; and others of a more slim and elegant shape, as Achilles is described. The former, devoting themselves to wrestling and boxing, had no object but to increase their bodily strength; the latter, educated to less violent exercises, such as running, leaping, &c. confined themselves to acquirement of agility.

"Their regimen is suited to the different exercises for which they are designed. Some of them abstain from women and wine; others lead a very abstemious life; but those who make laborious exertions stand in need of a great quantity of substantial food, such as roasted beef and pork, to restore their strength. If they require only two minæ a-day, with bread in proportion, they give a very favourable idea of their temperance. But several are mentioned who have made a terrible consumption of provisions. Theagenes of Thasos, for instance, is said to have eaten a whole ox in a day. The same exploit is attributed to Milo of Crotona, whose usual quantity of food for a day was twenty minæ of meat, as many of bread, and three congii of wine. It is said likewise, that Astydamas of Miletus, when at the table of Ariobarzanes

barzanes the Persian satrap, devoured alone the supper prepared for nine guests. These stories, no doubt exaggerated, prove at least the idea generally entertained of the voracity of this class of wrestlers. When they are able to gratify it without danger, they acquire extraordinary strength: their stature becomes sometimes gigantic; and their adversaries, struck with terror, either decline entering the lists, or sink under the weight of their enormous bodies.

"They are so oppressed by excess of nutriment as to be obliged to pass part of their lives in a profound sleep, and soon become so extremely corpulent as to be no longer known to be the same persons: this is succeeded by disorders which render them as wretched as they have always been unserviceable to their country; for it cannot be denied that wrestling, boxing, and all those combats disputed with so much fury and obstinacy in the public solemnities, are no longer any thing but ostentatious exhibitions, since tactics have been brought to perfection. Egypt at no time adopted them, as they give only a temporary strength. Lacedæmon has corrected their inconveniences by the wisdom of her institutions. In the other states of Greece men have discovered, that, by subjecting their children to them, they incur the risk of injuring their shape and preventing their growth; and that, in a more advanced age, professed wrestlers never make good soldiers, because they are unable to support hunger, thirst, watching, the smallest wants, or the most trifling deviation from their usual habits." See PENTATHLUM and PANCRATIUM.

PALÆSTROPHYLAX, was the director of the palæstra, and the exercises performed there.

PALEMBANG, a town and district on the north-east coast of the island of Sumatra, where the Dutch had a factory. The town is situated on a river of the same name, about 60 miles from the sea. The religion is Mahometan. The town and district were taken possession of by the British forces in 1812.

PALAMEDEA, a genus of birds belonging to the order of grallæ. See ORNITHOLOGY *Index*.

PALAMEDES, a Greek chief, son of Nauplius king of Eubœa, by Clemene. He was sent by the Grecian princes who were going to the Trojan war, in order to bring Ulysses to the camp, who, to avoid the expedition, pretended insanity; and the better to carry on the imposition, he often harnessed different animals to a plough, and sowed salt instead of barley. Palamedes soon discovered the cheat. He knew that regret to part with Penelope, whom Ulysses had lately married, was his only reason for pretending insanity; and to demonstrate this, Palamedes took Telemachus, of whom Penelope had lately been delivered, and put him before his father's plough. Ulysses turned the plough a different way, not to hurt his child. He was therefore obliged to attend the Greek princes to the war; but a mortal enmity took place between Ulysses and Palamedes. The king of Ithaca determined to take every opportunity to distress him; and when all his expectations were frustrated, he was mean enough to bribe one of his servants, and to make him dig a hole in his master's tent, and there conceal a large sum of money. After this Ulysses forged a letter in Phrygian characters, as from Priam to Palamedes. In the letter the Trojan king seemed to beg Palamedes to deliver into his hands the Grecian army, according to the conditions which had been previously agreed upon when he received the money. This forged letter was carried, by means of Ulysses, before the princes of the Grecian army, Palamedes was summoned, and made the most solemn protestations of innocence, but in vain. The money that was discovered in his tent served to corroborate the accusation; and he was therefore found guilty by the whole army, and stoned to death. Homer is silent about the unfortunate fate of Palamedes; and Pausanias mentions, that it had been reported by some that Ulysses and Diomedes had drowned him in the sea as he was fishing on the coast. Philostratus, who mentions the tragical story as above related, adds, that Achilles and Ajax buried his body with great pomp on the sea shore; and that they raised upon it a small chapel, where sacrifices were regularly offered by the inhabitants of Troas. Palamedes was a man of learning as well as a soldier; and, according to some, he completed the alphabet of Cadmus by the addition of the four letters θ, ξ, χ, φ, during the Trojan war. To him also is attributed the invention of dice and backgammon; and it is said that he was the first who regularly ranged an army in a line of battle, and who placed sentinels round the camp, and excited their vigilance and attention by giving them a watchword.

PALARIA, among the Romans, a kind of exercise performed at a stake by the soldiers. The stake being fixed in the ground, and six feet high above it, the young undisciplined soldiers advanced against it, armed with a hurdle and cudgel, instead of a sword and shield, and went through all the rules of attack and defence, as if actually engaged with an adversary. Sometimes they stood at a distance, and attacked with missive weapons; at the same time using all the requisite motions for defending themselves, and warding off what might be thrown against them.

PALATE, in *Anatomy*, the flesh that composes the roof, or the upper and inner part, of the mouth.

The palate has much the same structure with the gums; but it has also a great number of glands, discovered so early as the time of Fallopius: these are principally situated in the hinder part near the uvula, where it is pendulous, in the manner of a curtain, which part is called the *velum* or *claustrum*, of the palate. The glands situated particularly in this part, secrete a mucous fluid, serving to lubricate the mouth and throat, and to facilitate deglutition: they have a great number of apertures there for the discharge of this humour into the mouth.

The great uses of this membrane are, to defend the bones of the palate from corrupting; and for preventing, by its claustrum or velum, the things to be swallowed from getting up to the nostrils.

PALATINATE, a province or signiory, possessed by a palatine.

PALATINATE of the Rhine, a province of Germany, divided into two parts by the Rhine, called the *Upper* and *Lower Palatinate*. The former lies in the circle of Bavaria, and belongs to the elector thereof; but the latter, in the circle we are now treating, belongs to the elector palatine. The latter part is bounded to the east by the county of Katzenellnbogen, the archbishopric of Mentz, the bishopric of Worms, and part of the territory of the Teutonic order in Franconia; to the west by Alsace, the duchy of Deuxponts, the county of

Sponheim,

Sponheim, the duchy of Simmern, and certain districts of the electorate of Mentz; to the south by the duchy of Wurtemberg and the bishopric of Spire; and to the north by a part of the archbishopric of Mentz and the county of Katzenellnbogen. It contains 41 towns, besides several boroughs; and is about 100 miles in length, and 70 in breadth. The air is healthful, and the soil fruitful in corn, pasturage, wine, tobacco, and all sorts of pulse and fruits, particularly walnuts, chesnuts, and almonds. This country also breeds abundance of cattle, and is well watered by the Neckar, the Nahe, and the Rhine. In the last of these, near Germersheim and Selz, is found gold; the exclusive right of searching for which is farmed out by the elector. The state of religion hath varied greatly here since the Reformation, Lutheranism and Calvinism having been uppermost by turns, till the electorate devolved to the Popish branches of the family, when Popery, with all its superstition and mummery, was established anew: so that the Protestant religion is now on a very precarious footing in the Palatinate, though most of the natives are still of that persuasion: but the two sects of Protestants, namely, the Lutherans and Calvinists, have greatly contributed to their own ruin, by their mutual jealousy and animosity, being no less rancorous against one another than against their common adversaries the Papists. The Lutherans reckon themselves 50,000 strong, and are possessed of about 85 churches; but not one half of their preachers and schoolmasters have a competent maintenance. The number of Calvinist clergy here is estimated at 500, and that of the Roman Catholics at 400. Besides schools and Jesuit colleges in this country, there is one university, namely, that of Heidelberg; but there is very little trade in it except in wine. Authors are divided about the origin of the name *Palatines*, or *Psalzgraves*, as the Germans call them; but it seems most likely to be derived from the *palatia*, or palaces, which the old Frankish and German kings and Roman emperors were possessed of in different parts of the country, and over which they appointed supreme stewards or judges, who are called *Palatines* or *Psalzgraves*. The countries where these Palatines kept their courts, were, from them, called *Palatinates;* which name came at last to be appropriated, by way of eminence, to this country, as being the most considerable of them. The ancient electoral line failing in 1685, the electorate devolved to Philip William duke of Neuburg; and upon the death of his second son Charles Philip, to the prince of Sultzbach. This elector has the title of arch-treasurer of the empire, as well as the elector of Brunswick Lunenburg, and is the fifth in rank among the secular electors. He is also one of the vicars of the empire alternately with the elector of Bavaria, and enjoys many other prerogatives. In his own dominions, he disposes of all vacant benefices; but allows the ecclesiastical council, composed of two clergymen and two laymen, to present two candidates, of which he chooses one. He is also master of all the tithes in his dominions; but he either grants them to the clergy, or salaries in lieu of them, out of the revenues of the church. His title is Psalzgrave of the Rhine; arch-treasurer and elector of the holy Roman empire; duke of Bavaria, Juliers, Cleve, and Berg; prince of Mons; marquis of Bergen-op-Zoom; count of Veldens, Sponheim, the Mark, and Ravensberg; and lord of Ravenstein. His quota to the army of the empire is 30 horse and 138 foot, or 914 florins monthly. To the chamber of Wetzlar he contributes, each term, 404 rixdollars, 82 kruitzers. There is an order of knighthood in this country, viz. that of St Hubert; the badge of which is a quadrangular cross pendant to a red ribband, with a star on the breast. The whole of the elector's revenue, arising from the Palatinate, the duchies of Berg and Juliers, the seigniory of Ravenstein, and the duchies of Neuburg and Sultzbach, hath been estimated at about 300,000l. per annum. The military establishment consists of several regiments of horse and foot, besides the horse and Swiss life guards: in time of peace he is said to maintain about 6000 men.

The part of the Lower Palatinate on the left side of the Rhine was overrun by the French in 1795, and annexed to the republic under the name of the Department of Mont Tonnerre. Of what remained on the right side, the greater part was given at a subsequent period to Baden, to which it remains united. But in 1815 the district on the left bank was separated from France, and with some additions on the west and south, was given to the king of Bavaria. In the modern part of the Universal History, we have the following account of the rise of the Palatinate of the Rhine, under the history of Germany.

"Though Conrad the son of Everhard inherited from his father the duchy of Franconia, with the counties of Hesse and Alsace, he could not succeed him in the dignity of Count Palatine, because Otho had taken it from his father, and conferred it on Herman third son of Arnold duke of Bavaria: but as this honour was unattended with any solid advantage, the emperor began to annex to it the lands and castles situated on the Rhine, whence he acquired the title of Count Palatine of the Rhine: and, in process of time, these counts made great acquisitions by marriages, purchases, mortgages, and imperial donations, so as to form a very considerable province." The powers of counts palatine in the German empire have always been ample; we have this account of it in the same learned work.

"When the counts palatine of the Rhine began to execute their office, they neither possessed on that river lands, cities, nor castles; but having by degrees made great acquisitions by marriages, purchases, agreements, imperial donations, or otherwise, they have at length formed a very considerable principality. We are told, that under the emperors of the house of Suabia, their authority and power increased greatly, though it was a gradual increase. Under the reign of the emperor Henry IV. the credit of the counts palatine was very considerable at the court; and by the German law, the count palatine of the Rhine enjoys not only during the absence of the emperor, but likewise during a vacancy of the empire, the right of the ban beyond the Rhine, to within a mile of the city of Metz, and as far as the ocean, as well as in Flanders. However, this right of the ban has not been granted to him by the emperors. There is likewise an ancient ordonnance, in which the office of count palatine is mentioned; it imports, that the count palatine is always by right the representative or lieutenant of the kingdom. Lastly, How great the power of the counts palatine was, may be understood from this, that in the election of Rodolphus of Hapsburgh, and in that of Henry VII. the other electors promised to acknowledge as emperor him whom he should

should name. Although, however, the power of the counts palatine had as it were secured to them the vicariate of the empire, nevertheless the emperors still reserved to themselves the right of establishing vicars." See BAVARIA.

PALATINATES *of Poland*. Previous to the revolution in this unfortunate country, it was divided into palatinates; whether those will be now changed cannot at present be ascertained, though it seems likely. A Polish palatine is thus described in the Universal History.

"A palatine may be regarded as the governor of a province, who levies and leads the troops of his own jurisdiction to join the army of the republic. His civil power is likewise considerable, as he presides at the assemblies of his palatinate, rates the prices of all commodities and merchandise in the province, regulates the weights and measures, and judges and defends the Jews within his jurisdiction. This part of his function is particularly specified, that a set of men the most useful and industrious in Poland may not be oppressed; the king being likewise obliged, by his oath, to afford them the protection of the laws and his sovereignity. Under him is appointed a substitute or vice-palatine, who takes an oath to his superior, and must be possessed of a land estate to a certain value."

PALATINE, or COUNT PALATINE, a title anciently given to all persons who had any office or employment in the prince's palace: but afterwards conferred on those delegated by princes to hold courts of justice in the provinces; and on such among the lords as had a palace, that is, a court of justice, in their own houses.

Counties PALATINE in England.—Chester, Durham, and Lancaster, are called *counties palatine*. The two former are such by prescription, or immemorial custom; or, at least as old as the Norman conquest: the latter was created by King Edward III. in favour of Henry Plantagenet, first earl and then duke of Lancaster; whose heiress being married to John of Gaunt the king's son, the franchise was greatly enlarged and confirmed in parliament, to honour John of Gaunt himself, whom, on the death of his father-in-law, the king had also created duke of Lancaster. Counties palatine are also called *à palatio;* because the owners thereof, the earl of Chester, the bishop of Durham, and the duke of Lancaster, had in those counties *jura regalia*, as fully as the king hath in his palace; *regalem potestatem in omnibus*, as Bracton expresses it. They might pardon treasons, murders, and felonies; they appointed all judges and justices of the peace; all writs and indictments ran in their names, as in other counties in the king's; and all offences were said to be done against their peace, and not, as in other places, *contra pacem domini regis*. And indeed by the ancient law, in all peculiar jurisdictions, offences were said to be done against his peace in whose court they were tried; in a court-leet, *contra pacem domini;* in the court of a corporation, *contra pacem ballivorum;* in the sheriff's court or tourn, *contra pacem vicecomitis*. These palatine privileges (so similar to the regal independent jurisdictions usurped by the great barons on the continent during the weak and infant state of the first feudal kingdoms in Europe) were in all probability originally granted to the counties of Chester and Durham, because they bordered upon enemies countries, Wales and Scotland: in order that the owners, being encouraged by so large an authority, might be the more watchful in its defence; and that the inhabitants, having justice administered at home, might not be obliged to go out of the county, and leave it open to the enemy's incursions. And upon this account also there were formerly two other counties palatine, Pembrokeshire and Hexamshire, the latter now united with Northumberland: but these were abolished by parliament, the former in 27 Henry VIII. the latter in 14 Eliz. And in 27 Hen. VIII. likewise, the powers before mentioned of owners of counties palatine were abridged; the reason for their continuance in a manner ceasing; though still all writs are witnessed in their names, and all forfeitures for treason by the common law accrue to them.

Of these three, the county of Durham is now the only one remaining in the hands of a subject. For the earldom of Chester, as Camden testifies, was united to the crown by Henry III. and has ever since given title to the king's eldest son. And the county palatine or duchy of Lancaster was the property of Henry of Bolingbroke, the son of John of Gaunt, at the time when he wrested the crown from King Richard II. and assumed the title of Henry IV. But he was too prudent to suffer this to be united to the crown; lest, if he lost one, he should lose the other also. For, as Plowden and Sir Edward Coke observe, "he knew he had the duchy of Lancaster by sure and indefeasible title, but that his title to the crown was not so assured: for that after the decease of Richard II. the right of the crown was in the heir of Lionel duke of Clarence, second son of Edward III.; John of Gaunt, father to this Henry IV. being but the fourth son." And therefore he procured an act of parliament, in the first year of his reign, ordaining that the duchy of Lancaster, and all other his hereditary estates, with all their royalties and franchises, should remain to him and his heirs for ever; and should remain, descend, be administered, and governed, in like manner as if he never had attained the regal dignity: and thus they descended to his son and grandson Henry V. and Henry VI.; many new territories and privileges being annexed to the duchy by the former. Henry VI. being attainted in 1 Edw. IV. this duchy was declared in parliament to have become forfeited to the crown, and at the same time an act was made to incorporate the duchy of Lancaster, to continue the county palatine (which might otherwise have determined by the attainder), and to make the same parcel of the duchy: and, farther to vest the whole in King Edward IV. and his heirs, kings of England, for ever; but under a separate guiding and governance from the other inheritances of the crown. And in 1 Hen. VII. another act was made, to resume such part of the duchy lands as had been dismembered from it in the reign of Edw. IV. and to vest the inheritance of the whole in the king and his heirs for ever, as amply and largely, and in like manner, form, and condition, separate from the crown of England and possession of the same, as the three Henries and Edward IV. or any of them, had and held the same.

The isle of Ely is not a county palatine, though sometimes erroneously called so, but only a royal franchise: the bishop having, by grant of King Henry I. *jura regalia* within the isle of Ely; whereby he exercises a jurisdiction over all causes, as well criminal as civil.

PALATINE

Palatine Games, in Roman antiquity, games instituted in honour of Augustus by his wife Livia, after he had been enrolled among the gods. They were celebrated in the palace, from whence the name, and were confirmed by the succeeding emperors.

Some authors say that these games were instituted in honour of Julius Cæsar, and others again confound them with the Ludi Augustales; but neither of these opinions seems to be well supported. See AUGUSTALES.

PALATINUS MONS, or *Palatium*, the first mountain of Rome occupied by Romulus, and where he fixed his residence and kept his court, as did Tullus Hostilius, Augustus, and all the succeeding emperors; and hence it is that the residence of princes is called *palatium*. The reason of the name is variously assigned; some say it is derived from the goddess Pales, or from the Palatini, who originally inhabited the place, or from *balare* or *palare*, the bleatings of sheep, which were frequent there; or perhaps from the word *palantes*, wandering, because Evander, when he came to settle in Italy, gathered all the inhabitants, and made them all one society. To the east it has Mount Cœlius, to the south the Aventine, to the west the Capitoline, and to the north the Forum.—*Palatinus*, the surname of Apollo from this place; where Augustus built a temple to that god, adorned with porticoes and a library, valuable for the various collections of Greek and Latin manuscripts which it contained.

PALATIUM, in *Ancient Geography*, a place in the territory of Reate, distant from it 25 stadia. Dionysius Halicarnasseus reckons it one of the first towns of the Aborigines; and from it Varro accounts for the name of the *Mons Palatinus;* namely, that a colony from Palatium settled there.

PALATIUM (Pliny), *Pallantium* (Pausanias), *Palanteum* (Livy); *Pallanteum* (Solinus). This last is the true writing; the great grandfather of Evander, from whom it took its name, being called *Pallas*, not *Palas;* A town of Arcadia, which concurred to form Megalopolis (Pausanias). From it the *Palatium*, or *Mons Palatinus*, takes also its name, according to Virgil and Pliny.

Palatium Dioclesiani; the villa of Dioclesian, near Salonæ, where he died, (Eusebius). Afterwards called *Spalatum;* which rose to a considerable city from the ruins of Salonæ; situated in Dalmatia on the Adriatic. Now *Spallato*, or *Spalatro*.

Palatium Luculli (Plutarch), or *Villa Luculli;* a place between Misenum and Baiæ in Campania, of wonderful structure. Now in ruins, and called *Piscina Mirabile*.

PALATO-SALPINGÆUS, } See ANATOMY, *Table*
Palato-Staphylinus. } *of the Muscles*.

PALE, a little pointed stake or piece of wood used in making enclosures, separations, &c. The *pale* was an instrument of punishment and execution among the ancient Romans, and still continues so among the Turks. Hence empaling, the passing a sharp pale up the fundament through the body.

PALE, in *Heraldry*. See HERALDRY.

PALENCIA, a town of Spain, in the kingdom of Leon, with a rich archbishop's see. It had an university, but it was removed to Salamanca. It is seated in a fertile soil, on the river Carion, on the frontiers of Castile, in W. Long. 3. 7. N. Lat. 42. 10.

PALERMO, a city of Sicily, in the Val-di-Mazara, with an archbishop's see and a large harbour. "This city (says Mr Hill *), which is the capital of Sicily, is of great antiquity; and if a conjecture may be formed from its ancient name *Panormus*, which signifies an universal harbour, it was formerly in a very flourishing condition. By whom it was founded is uncertain, nor have we any authentic accounts of its inhabitants till it became a colony of the Phœnicians, after which it passed into the hands of the various nations that became masters of this island. The present city principally consists of two wide, uniform, and well built streets, each about a mile in length, crossing each other at right angles in the centre, where there is a small octagon space, ornamented with four statues." Most of the cities of Sicily have surnames: Palermo is denominated *the happy*. It has gained this epithet, no doubt, on account of the advantages of its situation. It has two harbours: in the one, which is very large, and in which there is a mole 1300 paces in length, ships lie at anchor; in the other their cargoes are laden and unladen. Both the harbours open to the west: there is also a superb quay which extends a mile from west to east, in a rectilinear direction, and is called *La Marine*. The prospect is, on the one side, lost in the wide expanse of the ocean, and on the other confined by the walls of the city; the walls appear adorned with pilasters, and crowned with a row of ballustrades through which the eye discovers a long range of palaces. These objects altogether form a delightful spectacle. Indeed nothing can be more picturesque than the bay of Palermo. It forms a large amphitheatre, with the capital of Sicily in the centre; surrounded for some miles by a most delightful country, and enclosed by romantic rocks and mountains. The town was formerly surrounded by a strong wall; but the fortifications are now entirely neglected, except towards the sea, where there are still a few weak works. The quay is the principal public walk here. Palermo is embellished all around with avenues of trees, and has four principal entrances, facing the four cardinal points, which are at the extremities of the two spacious streets which cross each other. The most frequented of these two streets is called *Cassero*. It begins where the quay ends, with the north gate called *Porta Felice*, the happy gate; and terminates on the south, at the new gate, which opens on the road to Montreale. Near the last of these gates, this city, which so well merits the attention of a lover of the arts, exhibits a large square, round which stand some extensive monasteries, the palace of the archbishop, and the palace of the viceroy. Directly opposite to the palace of the viceroy stands, on a pedestal richly ornamented with a variety of figures, a statue of Philip IV. The statue, the pedestal, and the ornaments are all of marble.

* *Travels through Sicily and Calabria.*

Palermo is quite filled with public monuments, churches, monasteries, palaces, fountains, statues, and columns. These are not all eminently beautiful; for they have not been all erected under the reign of *good taste;* but every one of them shows that the nation is fond of the arts, and possesses a genius for decoration. Spring waters are very copious in this city. Not a quarter in Palermo but is liberally supplied with fountains,

tains, most of which are marble, all of them adorned with pieces of sculpture, and all afford large quantities of water.

The situation of this city is truly happy; the sea, the hills, the lofty mountains, present on all sides beautiful and striking prospects, which render it one of the most favourable situations for the genius of the artist, whose object is to copy the beauty and sublimity of nature. Freed from the fetters of the Inquisition, the abolition of which was procured by the marquis of Caraccioli, and from the influence of some other unfavourable institutions, which are rapidly declining, Palermo must become one of the finest cities in the world; and the island, of which it is the capital, being all cultivated like a garden, one of the most enchanting spots on the face of the earth. Nature has denied none of her best spots to Sicily. It was the benignity of nature, which, in the happy ages of antiquity, when the political circumstances of the Sicilians were not such as to repress their genius, prompted and enabled them to erect so many illustrious monuments. "Adjoining to the town, and near the sea, is a public garden or promenade, planted with orange and lemon trees, formed into arcades, and now loaded with fruit *; the stems of the trees stand in furrows, and are continually watered by a small stream. In the middle is a fountain, on which stands a colossus of white marble, surrounded by four grotesque temples, in two of which are canary birds. Among the oranges is a kind called *sanguinei* or bloody, which are stained in the middle with red, and have usually the finest flavour. Some of the lemons are sweet, but very flat, tasting like sugar and water. The citrons grow to an immense size; the rind, which occupies at least three-fourths of the bulk of the fruit, is eaten with sugar; the juice is sharper than the sourest lemon. Indian figs in very great abundance grow wild in the fields and hedges, to the height of twelve or fourteen feet: of these there are three kinds, one with large spines, another with smaller, and the third almost smooth. Their fruit is cooling and delicious, 10,000l. worth of which is sold annually to the poor people in the neighbourhood of this city. Another plant, very common in this country, is the aloe, which usually blossoms every fifth or sixth year. Of these there are five or six species, which grow mostly in the hedges, and together with the Indian figs, form a most impenetrable fence.

* February.

"The palace, which is an indifferent old building, is situated in a square, near the south gate of the city, and commands a delightful prospect of the adjacent country. At the top is an observatory, inhabited by an ingenious old priest who has been in England, and brought from thence several astronomical instruments constructed by Ramsden." Neither the structure, situation, nor architectural ornaments of the palace are such as to merit any extraordinary praise. It is, like many others, an assemblage of buildings erected in various ages, as need of accommodation or fancy suggested; and, of consequence, it must unavoidably be defective in architectural order and beauty. The chapel is the only part of it that merits any attention. It was founded by the Counts Roger, the Norman conquerors of Sicily. Within, it is decorated with beautiful pieces of marble and porphyry, and of mosaic work in gold and various colours. It is in the same taste with the cathedral of Montreale. It is built on the same plan with common churches, only on a smaller scale. The nave is encircled with pillars; on the right and the left are two narrower openings, called *lateral* or low passages: the choir and sanctuary are at the end of the nave. Among all the pillars which enclose the nave, it would be hard to find two exactly of the same form and workmanship. Opposite to a channelled column stands another on which the graving tool has made no such impressions; several have neither astragal, nor base, nor scale: they are formed of various kinds of marble, and are of different orders and unequal in height. The walls, the arcades, and the arches, are covered with mosaic work, in gold and colours, representing angels, and male and female saints.

Over the entrance into the choir, and fronting the nave, there is an Eternal Father of a huge size; the design of which has, in all probability, been to impress the beholder with a sufficiently awful idea of the greatness of God. Such representations of the deity, however improper, not to say impious, occur pretty commonly in the churches of Sicily. The cathedrals of both Montreale and Palermo display the Divine Majesty with equal dignity. Over the walls of the chapel there are many pieces of granite, porphyry, and serpentine, cut into a round, or a square, or some other form, and set like panes of glass. Their edges are encircled with various draughts in gold and colours; decorations unquestionable expensive, as they are indeed very finely executed in their kind. But it is amazing that such irregularity of design was admitted in a building of such magnificence and raised at such an enormous expence. The pavement of the chapel has been originally laid, and still consists in part of large blocks of tin, porphyry, and serpentine. Most of these are round; ornamented with compartments of draughts, and covered over, as well as the walls, with incrustations of coloured mosaic work. The seat designed for the viceroy is of the same kind, and highly ornamented. The candlestick intended to receive the wax lights at the festival of Easter is of white marble. All the riches of sculpture are lavished on it with such profusion as renders it a prodigy of labour; but in a fantastic unnatural taste.

In a long gallery in the palace of the viceroy, stand two figures of rams in bronze, concerning which we find the following tradition.—Archimedes is said to have long ago erected in one of the public squares of Syracuse four columns with a brazen ram upon the top of each. He is said to have placed them there in such a posture, as that some one of them always indicated which of the four principal winds was blowing; and it is added, that they were fabricated with such art, that the wind caused them to utter sounds exactly similar to the bleating of sheep; and whenever any one of the four bleated, he thereby gave notice that the wind was blowing from that quarter towards which he stood. It is certain (as travellers inform us) that the two brazen rams in this gallery are perforated with small holes in their flanks, close to their thighs, and in other places over their bodies; and that by blowing through those holes a sound is produced pretty much like the bleating of sheep. The wind appears to pass through the holes, and to pass out at the mouth: there might, however, be other holes in the pedestal on which the ram stood, or in other parts of the body, which might contribute to produce

produce the bleating; for travellers agree in saying, that those which they could observe do not appear to be sufficient to produce the effect. The prince of Torre Muzza, one of the most enlightened men in Sicily, informed M. Houel, that these two rams were dug up from among the ruins of Syracuse in the fourteenth century: as they were buried under ground, they had probably lain there for many centuries. They were bought by the Marquis Geraci, of the family of Ventimiglia, and lay long in his castle. About the end of the 15th century they were brought to Palermo, and placed in the palace of the viceroy. It is not known what is become of the other two. They are probably buried in some ancient ruins, and may be one day or other discovered in digging for the foundation of some new building. The proportions of these two rams are larger than nature. They are pieces of very fine workmanship: both the heads and the horns are formed with taste, delicacy, and truth; the wool is not so well executed; the forms all together are not absolutely the finest that might be selected from among the whole species.

The cathedral of Palermo is dedicated to St Rosalia. The Sicilians, though so exceedingly devout, have however neglected to repair it; and it is at present in a most miserable state, as the interior parts appear to be falling into ruins. Proposals have been made for rebuilding it, and various plans have been shown.

The present church appears to have been built by the Counts Roger. The external parts are in a Gothic taste, and very heavy: within, it has been at different periods repaired and embellished. The pillars of the nave are adorned with pilasters of the Corinthian order: these are joined by arches through which you pass to the sides of the building. In some places it is overloaded with ornaments, in others but very poorly ornamented: viewed all together, it is so destitute of order or proportion, as to be absolutely ridiculous.

In a chapel on one side of the cathedral are four Gothic tombs of the same period. They have been originally sarcophagi; and having escaped the fate of most of the other works of antiquity, have been spoiled by attempts to repair or improve them, and have been set up here to preserve the remains of some of the kings of Sicily. The only thing about them that can deserve attention is the beauty of the stone; they are of a fine red porphyry.

In the same chapel there is a fine large tabernacle; the whole of which, when viewed without distinction of the parts, resembles the dome and the front gate of the Val-de-grace at Paris. It is of rich lapis lazuli, of the very finest colour. The whole of it is plated, and the pillars are said to be solid. All its ornaments are of gilt brass; and on the whole it is extremely beautiful.

Around the church are several statues of saints by Guagini, the celebrated sculptor. On the way from the cathedral down the Cassero there is, on the right hand, a small square, at the entrance of which stands a pedestrian statue of Charles V. in bronze. Near the place where the two great streets cross stands the senate house, in a small court, before which there is a fine marble fountain; there are besides about this edifice many curious fragments of antiquity. It would extend this article beyond all proportion if we were to mention all the curiosities which are to be found in Palermo. We shall now endeavour to give our readers an idea of the internal government of the place, which we shall do in the words of Mr Hill.

"The magistrates appointed to preserve the order of society in this city are, first, the supreme judge, to whom belongs the administration of justice in criminal cases; he is the head of the nobility, and immediately follows the viceroy in all the solemn functions. Secondly, The prætor, who regulates the affairs of the city. He is the perpetual deputy of the kingdom; chief in parliament of the order to whom appertains the right of regulating the king's demesne, and possessed of the prerogative of captain-general during the absence of the viceroy. Thirdly, The prætorian court, which consists of three judges, citizens of Palermo, who are chosen annually by the king. They assist the supreme judge in the decision of criminal affairs, and the prætor in the deliberations upon the finances; these two officers, however, have neither vote nor signature, except the prætor, in the business respecting the public bank and first fruits. Fourthly, The senate of Palermo, composed of the prætor and six practitioners of the law, named by the king, who wear the toga after the manner of the ancient Roman senators, and principally inspect the police which regards the grain and provisions. There are besides seven great officers of state, to each of whom is assigned a peculiar employment. First, *Il Maestro Portelano*, to whom is committed the care of the public granaries, and who manages the sale of the corn both at home and abroad. The imposition of a tax upon this commodity has nearly proved the ruin of agriculture, especially as the exportation of it is prohibited to all those who are not able to pay an exorbitant price for that privilege. The quantity of corn annually produced in the island does not at present amount to more than a tenth part of what was collected in former years. Secondly, The auditor general, who passes judgment without appeal upon all offences committed within the precincts of the palace. Thirdly, The high admiral, whose jurisdiction extends over the marine. Fourthly, The chancellor, who overlooks all the notaries of the kingdom, prepares all official patents, reads the propositions when the parliament assembles, and at the time of a coronation tenders the oath of fidelity to the people, and also proclaims that of the monarch, who thereby binds himself to maintain and defend the privileges of the city of Palermo. The same ceremony takes place upon the installation of a viceroy. Fifthly, The prothonotary of the queen's chamber, who has the inspection of the demesnes of six cities, viz. Syracuse, Lentini, Carlentini, St Filippo, Mineo, and Virini, which were formerly appropriated to the queens of Sicily. Sixthly, The chief secretary, who presides over the officers appointed to receive the taxes and duties in the places of their respective jurisdictions. And, seventhly, The lieutenant of the royal exchequer, who has the administration of all effects that have been sequestered or confiscated.

"Palermo is the principal residence of the greater part of the Sicilian nobility; and as it is not the custom for any gentleman to walk in the streets, at least 1000 carriages are said to be kept in the town. They are for the most part in the English taste, very elegant, Palermo. shown to the greatest advantage, with beautiful horses richly caparisoned, and as many footmen in splendid liveries as can be crowded together behind. Every evening all the people of rank drive about in this manner on the grand public terrace by the sea side. There are also very convenient hackney coaches, covered and open, waiting all day in their respective stations."

It is very remarkable, that the dead in Palermo are never buried. Captain Sutherland gives the following account of this circumstance in his Tour to Constantinople. The dead bodies are carried to the Capuchin convent, which is one of the largest in Italy; "where, after the funeral service is performed, they are dried in a stove heated by a composition of lime, which makes the skin adhere to the bones. They are then placed erect in niches, and fastened to the wall by the back or neck. A piece of coarse drab is thrown over the shoulders and round the waist; and their hands are tied together, holding a piece of paper with their epitaph, which is simply their names, age, and when they died. We of course (says Captain Sutherland) visited this famous repository; and it is natural to suppose that so many corpses would impress one with reverence and awe. It was nearly dusk when we arrived at the convent. We passed the chapel, where one of the order had just finished saying vespers, by the gloomy glimmering of a dying lamp. We were then conducted through a garden, where the yew, the cypress, and the barren orange, obscured the remaining light; and where melancholy silence is only disturbed by the hollow murmuring of a feeble waterfall. All these circumstances tuned our minds for the dismal scene which we were going to behold; but we had still to descend a flight of steps impervious to the sun; and, these at last, conveyed us to the dreary mansion of the dead. But (will you believe me?) notwithstanding the chilling scene through which we had passed, notwithstanding our being in the midst of more than a thousand lifeless bodies, neither our respect for the dead, nor for the holy fathers who conducted us, could prevent our smiling. The physiognomies of the deceased are so ridiculously mutilated, and their muscles so contracted and distorted in the drying, that no French mimic could equal their grimaces. Most of the corpses have lost the lower part of the nose; their necks are generally a little twisted; their mouths drawn awry in one direction; their noses in another; their eyes sunk and pointed different ways; one ear perhaps turned up, the other drawn down. The friars soon observed the mirth which these unexpected visages occasioned; and one of them, as a kind of *memento*, pointed out to me a captain of cavalry, who had just been cut off in the pride of his youth: but three months ago, he was the minion of a king—the favourite of a princess—Alas! how changed! Even on earth there is no distinction between him and the meanest beggar. This idea in a moment restored my reflection; and I felt with full force the folly of human vanity. I turned to the holy father, who gave me this lesson. His eyes were fixed on what was once a captain of horse.—I saw in them, 'Read this, titled pomp, and shrink to thy original nothingness. Hie thee to my lady's chamber; tell her, though she paint an inch thick, to this must she come at last—make her laugh at that.' The relations of the deceased are bound to send two wax tapers every year for the use of the convent; in default of which, the corpse is taken down and thrown into the charnel house. Were it not for the number of vacancies occasioned by the nonpayment of this stipend, the Capuchins would be unable to find niches for the number of men who must die every year in so populous a city as this. Women are dried as well as the men, but are not exposed. Nobles are shut up in chests."

Palermo ‖ Palestine.

The number of the inhabitants is above 200,000; and the harbour, though very large, is not so commodious as might be expected, and the vessels that ride therein are not always very safe. There is a magnificent castle built near the sea side, wherein the viceroy resides six months in the year; and his presence draws a great number of nobility to this place. This city has suffered greatly by earthquakes, particularly in 1693; and it was greatly damaged by fire in 1730, when a magazine of powder was blown up, containing 400 tons. It stands in a pleasant fruitful country, on the north-east coast of the island, and at the bottom of the gulf of the same name. E. Long. 13. 23. N. Lat. 38. 15.

PALES, in Pagan worship, the goddess of the shepherds, to whom they offered milk and honey, in order that she might deliver them and their flocks from wild beasts and infectious diseases. This goddess is represented as an old woman. She was worshipped with great solemnity at Rome; and her festivals, called *Palilia*, were celebrated on the 21st of April, the very day that Romulus began to lay the foundation of the city of Rome; the ceremonies of which consisted in burning heaps of straw, and leaping over them. No sacrifices were offered, but purifications were made with the smoke of horses blood, and with the ashes of a calf that had been taken from the belly of its mother after it had been sacrificed, and with the ashes of beans. The purification of the flocks was also made with the smoke of sulphur, of the olive, the pine, the laurel, and the rosemary. Offerings of mild cheese, boiled wine, and cakes of millet, were afterwards made to the goddess. Some call the festival *Parilia*, *quasi à pariendo*, because the sacrifices were offered to the divinity for the fecundity of the flocks.

PALESTINE, in its present state, is a part of Asiatic Turkey, situated between 31° 30′ and 33° 20′ north latitude, and between 34° 50′ and 37° 15′ east longitude. It is bounded by Mount Libanus, which divides it from Syria, on the north; by Mount Hermon, which separates it from Arabia Deserta on the east; by the mountains of Seir and the deserts of Arabia Petræa, on the south; and by the Mediterranean sea on the west.

This once fertile and happy spot was first called the land of *Canaan*, or *Chanaan*, from Noah's grandson. In Scripture, however, it is frequently distinguished by other names; such as the *Land of Promise*, the *Land of God*, the *Land of Israel*, &c. It received the name of *Palestine* from the *Palestines* or *Philistines*, who possessed a great part of it; and it has the name of *Judea*, or *Judea Palestina*, from *Judah*, the most considerable of the twelve sons of Jacob. The Christians have denominated it the *Holy Land*; partly on account of the many singular blessings it received from the Divine Providence, and partly on account of its metropolis being made

made the centre of God's worship and his peculiar habitation; but much more for its being the place of our Saviour's birth, the scene of his preaching and manifold miracles: especially the place in which he accomplished the great work of our redemption. As to the name of *Judea*, it did not begin to receive that till after the return of the Jews from the Babylonish captivity, though it had been styled long before the *Kingdom of Judah*, in opposition to that of *Israel*, which revolted from it under Jeroboam, in the reign of Rehoboam the son of Solomon. But after the return, the tribe of Judah, the only one that made any figure, settling at Jerusalem, and in the countries adjacent, quickly gave its name to the whole territory. By profane authors it was called by many different names; such as Syria, Palestina Syria, Cœlosyria, Iduma, Idumæa, and Phœnicia or Phœnice; but these are supposed only to have been given out of contempt to the Jewish nation, whom they looked upon as unworthy of any other name than what distinguished the most obscure parts of the neighbouring provinces.

That part of the country which was properly called the *Land of Promise*, was enclosed on the west by the Mediterranean; on the east by the lake Asphaltites, the Jordan, the sea of Tiberias or of Galilee, and the Samachonite lake; to the north it had the mountains of Libanus, or rather of Antilibanus, or the province of Phœnicia; and to the south, that of Edom or Idumæa, from which it was likewise parted by another ridge of high mountains. The boundaries of the other part, which belonged to the two tribes and a half beyond the river Jordan, are not so easily defined, as well as those of the conquests made by the more prosperous kings of the Jews. All that can be said with any probability is, that the river Arnon was the first northern boundary on that side; and with respect to those on this side the Jordan, there is a considerable disagreement between the Hebrew and Samaritan versions of the Pentateuch.

The extant of this country is likewise variously settled by geographers; some giving it no more than 170 or 180 miles from north to south, and 140 in breadth where broadest, though not much above half that breadth where narrowest. But from the latest and most accurate maps, it appears to extend near 200 miles in length, and about 80 in breadth about the middle, and about 10 or 15, more or less, where it widens or contracts.

The climate is certainly very happy, its situation being neither too far south nor too far north. The longest day is not above 14 hours 15 minutes: But the limits of Palestine appear so small, considering that the country is likewise intersected by high ridges of mountains, woods, deserts, &c. that many learned men have been induced to question what we read of its fertility and populousness in former times. It must be owned, indeed, that when we compare its ancient and flourishing state, when it was cultivated with the most diligence, by persons well skilled in every branch of agriculture, with what it has been since the total extirpation of the Jews out of it, and more especially since it fell into the hands of the Turks, the contrast is amazingly great: but when we consider the many evident causes which have contributed to effect this change, and even yet consider the nature of the country itself, we find not the least reason to doubt the truth of what the sacred historians have related. Moses describes the richness of it in the strongest terms, even before the Israelites got possession of it. It even exceeded the land of Egypt, so much celebrated by ancient historians; especially in the vast numbers of cattle which it produced; in the quantity and excellence of its wine, oil, and fruits. With respect to the oil and fruits, it is plain, that the olives and oil of Canaan exceeded in goodness those of Egypt, since the tribes sent them thither from thence; and as for vines, Herodotus tells us, that the Egyptians had none at all, but supplied the want of them by a liquor brewed from barley. The presents which Jacob sent to his son Joseph, of honey, spices, myrrh, almonds, and other fruits of Palestine, show that they must have been much better in the land of Judea than in Egypt. The wines of Gaza, Ascalon, and Sarepta, were famous among the most remote nations; though it is allowed, that the wine which was made at and in the neighbourhood of Bethlehem, in great quantities, was equal at least, if not superior, to any of the rest: and that of Libanus, mentioned by the prophet Hosea, was no less celebrated for its excellent flavour.

Several circumstances contributed to this wonderful fecundity: such as, the excellent temperature of the air, which was never subject to excessive heats or colds; the regularity of its seasons, especially the former and latter rain; and the natural fatness and fertility of its soil, which required neither dunging nor manuring, and could be ploughed with a single yoke of oxen and a small kind of plough; for the soil was, and is still, so shallow, that to have gone deep into it, would rather have endangered than improved the crop. With respect to the excellency of its corn, we are told, that the bread of Jerusalem was preferred above all other; and the tribe of Asher produced the best of both, and in greater quantity than any other tribe; and such plenty was there of it, that, besides what sufficed the inhabitants, who made it their chief sustenance, Solomon, we read, could afford to send 20,000 cors, or measures, of it, and as many of oil, yearly, to Hiram king of Tyre; besides what they exported into other countries. And we find, even so late as King Herod, surnamed Agrippa, the countries of Tyre and Sidon received most of their sustenance from his tetrarchy.

As to their fruits, the grapes were delicious, finely flavoured, and very large. The palm tree and its dates were in no less request; and the plain of Jericho, among other places, was famed for the great plenty and excellence of that fruit; insomuch, that the metropolis of that territory was emphatically styled *the city of palm trees*. But what both this plain, and other parts of Palestine, were most celebrated for, was the balsam shrub, whose balm was esteemed so precious a drug among the Greeks, Romans, Egyptians, and other nations, and is still to this day, under the name of *balm of Gilead*. They had likewise the greatest variety of other fruit trees in the highest perfection; and which might be, in some sense, styled *perpetual*, because they were not only covered with a constant verdure, but because the new buds always appeared on the same boughs before the old fruit was ripe; and of those buds, which were in too great quantities to be allowed to come to maturity, they gathered enough to make very delightful pickles and

Palestine. sweetmeats, especially of their citrons, oranges, and apples of paradise, which last commonly hung by hundreds in a cluster, and as big as hens eggs, and of an excellent taste and flavour. Their vines yielded grapes twice, and sometimes three times a year, great quantities of which were dried up, and preserved for use, as well as their figs, plums, and other fruits. They had plenty of honey; the very trees distilled it; and the rocks yielded it in great quantities: but whether that of the latter kind was there deposited by the industrious bees, or produced some other way, is much disputed by travellers and naturalists. They likewise cultivated sugar canes in great abundance; and the cotton, hemp, and flax, were mostly of their own growth and manufacture, except some of a finer sort, that were brought to them from Egypt, and worn by those of the higher rank. Their vicinity to Libanus made the cedars, cypresses, and other stately fragrant trees, very common in most parts of the land, but more especially in Jerusalem. Cattle, both large and small, they fed in vast quantities; and the hilly countries not only afforded them variety and plenty of pasture, but also of water, which descended thence into the valleys and low lands, and fertilized them to the degree we have seen; besides several other rivers and brooks, some of the most remarkable of which we shall speak of in their proper places. But the most fertile pasture grounds were those on each side of the river Jordan; besides those of Sharon, or Sarona, the plains of Lydda, Jamnia, and some others then justly famed for their fecundity. As for fish, the river abovementioned, the lake of Tiberias, and the Mediterranean sea, afforded, as they do to this day, great plenty and variety. Vast quantities were brought to Jerusalem, on which the inhabitants mostly subsisted; and hence one of the gates of that metropolis was, according to St Jerome, called the *fish gate*. The lake Asphaltites yielded salt in abundance, wherewith to season and preserve their fish, which Galen affirms to have been preferable to any other for wholesomeness, digestion, and extenuation. In short, the Scripture is so pregnant with proofs of the extraordinary richness and fecundity of this once happy land, and the vast number of people that lived in it, almost wholly upon its product, to say nothing of the vast exports of its corn, wine, oil, raisins, and other fruits, &c. that a man must have taken a strange warp to infidelity, that can call it in question, merely on account of the melancholy and quite opposite figure it now makes under its present tyrannical government.

But its fertility has been called in question; and Voltaire and other infidel writers have raised difficulties and objections against the authority of Scripture, from the pretended sterility of the land of Judea. In answer to which, the abbé Guenée, about the year 1780, communicated to the Academy of Inscriptions and Belles Lettres at Paris, *Two Memoirs concerning the Fertility of Palestine*, in order to show that such objections had no solid foundation.

In the first of them, the author proves, that from the captivity of Babylon to the war of Adrian, Judea was always considered as a rich and fertile country. The positive and multiplied authorities of the writers of that period, Jews, Greeks, and Romans, not only attest in general the fertility of that country, but many of these writers, entering into a particular detail of circumstances, prove it from the nature of the climate, the qualities of the soil, and the excellencies and variety of its productions. These are confirmed by proofs of another kind, but which are of a very convincing nature, even those resulting from a great number of medals struck under the reigns of the kings of Syria and Judea, and under the Romans, both by Jews and Pagans, and which all bear the symbols of a rich fertility. To these proofs are added a multitude of facts, recorded in the history of the Jews during this period; the efforts of the neighbouring kings to conquer their country; the long and bloody wars that the Jews carried on with vigour, and sometimes with success, against powerful princes and nations; the tribute and taxes they paid to the kings of Egypt and Syria, to the Romans, and to their own princes; the magnificence of their sovereigns, and among others of Herod; the troops he raised and kept on foot; the temples, fortresses, palaces, and cities, which he erected and embellished, not only in his own country, but also in Syria, Asia Minor, and even in Greece; the immense sums he lavished among the Romans, the donations he made to his own people, and the vast treasures which he left behind him: all these circumstances concur in proving the fertility and riches of Palestine during that period.

In the second memoir, the Abbé Guenée considers the state of Palestine as it was from the time of the emperor Adrian to the caliphate of Omar, which comprehends a period of four centuries. From sundry facts he shows, that it could not then have been the barren country which it has been represented by some sceptical writers. He particularly mentions the project formed by Adrian of rebuilding and embellishing Jerusalem, of forming it into a Roman colony, and giving it his own name; a project of which he could never have entertained a thought, if Judea, which he had seen and examined with his own eyes, had appeared to him such a barren and wretched country as it is said to be by some who have neither seen that country nor examined the matter with care and attention. Our author also produces a variety of other facts, to show that Judea, after all that it had suffered from the desolations of war both in ancient and latter times, still remained at the period in question fertile, rich, and populous. This is the idea which the writers of the time, Pagan and Christian, as well as Jewish, have given of Palestine. Antoninus Martyr, a citizen of Placentia, who in the 6th century travelled to Palestine, and composed an account of his voyage, which is still extant, says, that the canton of Nazareth was not inferior to Egypt in corn and fruits; and that though the territory of that city was not very extensive, it abounded in wine and oil, and excellent honey. The country about Jericho appeared to him still more fertile. He saw Mount Tabor, which he represents as surrounded with cities: and he observed, in the neighbourhood of Jerusalem, vineyards, great plantations of fruit trees, and through the whole country a considerable number of hospitals, monasteries, and beautiful edifices. Our learned abbé, in concluding his work, acknowledges, that the opulence and fertility of Judea might begin to diminish towards the middle of the period treated of in his second memoir: but he does not think

think that any argument can be drawn from hence against its having been at the commencement of this period in a flourishing state; and much less can any proof be brought from hence, that in preceding periods, under the kings, or under the administration of Moses, the country of Palestine was a barren and uncultivated district.

Besides, it ought to be considered, that it was then inhabited by an industrious people, who knew how to improve every inch of their land, and had made even the most desert and barren places to yield some kind of productions, by proper care and manure; so that the very rocks, which now appear quite bare and naked, were made to produce corn, pulse, or pasture; being, by the industry of the old inhabitants, covered with mould, which, through the laziness of the succeeding proprietors, has been since washed off with rains and storms. We may add, that the kings themselves were not above encouraging all kinds of agriculture, both by precept and example; and, above all, that they had the divine blessing promised to their honest endeavours and industry: whereas it is now, and hath been long since, inhabited by a poor, lazy, indolent people, groaning under an intolerable servitude and all manner of discouragements; by which their aversion to labour and agriculture, farther than what barely serves to supply their present wants, is become in a manner natural and invincible. We may further observe, after the judicious Mr Maundrell, that there is no forming an idea of its ancient flourishing state, when under the influence of heaven, from what it is now under a visible curse. And, if we had not several concurring testimonies from profane authors, who have extolled the fecundity of Palestine, that single one of Julian the Apostate, a sworn enemy to Jews and Christians, as well as to all the sacred writings, would be more than sufficient to prove it; who frequently makes mention, in his epistles, of the perpetuity, as well as excellence and great abundance, of its fruits and products. The visible effects of God's anger, which this country has felt not only under Titus Vespasian (when myriads of inhabitants were either slain, or perished by the most severe famine, pestilence, and other calamities, and the rest sold for slaves into all lands; and new colonies sent to repeople it, who found it in such desolate state, as quite discouraged them from restoring it to its pristine fruitfulness); but much more since that emperor's time, in the inundations of the northern barbarians, of the Saracens, and of the more cruel and destructive Christians during the crusades; and in the oppression it now feels under the Turkish yoke, may be easily owned to be more than sufficient to have wrought the dismal change we are speaking of, and to have reduced the far greater part into a mere desert.

Nevertheless, if we may credit those who have viewed it in this doleful condition, they will tell us, there are still such visible signs of its natural richness and fertility, as plainly show, that the bare want of culture is the main if not the only cause of its present poverty and barrenness. We shall hint, as a farther proof of this, what a learned traveller hath lately written of it from his own observations.

"The Holy Land (says Dr Shaw), were it as well peopled and cultivated as in former times, would still be more fruitful than the very best part of the coast of Syria and Phoenice; for the soil is generally much richer, and, all things considered, yields a preferable crop. Thus the cotton that is gathered in the plains of Ramah, Esdraelon, and Zabulun, is in greater esteem than what is cultivated near Sidon and Tripoli. Neither is it possible for pulse, wheat, or any sort of grain to be more excellent than what is sold at Jerusalem. The barrenness, or scarcity rather, which some authors may, either ignorantly or maliciously, complain of, doth not proceed from the incapacity or natural unfruitfulness of the country, but from the want of inhabitants, and the great aversion there is to labour and industry in those few who possess it. There are, besides, such perpetual discords and depredations among the petty princes who share this fine country, that, allowing it was better peopled, yet there would be small encouragement to sow, when it was uncertain who should gather in the harvest. Otherwise, the land is a good land, and still capable of affording its neighbours the like supplies of corn and oil which it is known to have done in the time of Solomon."

And Volney, in his Travels in Egypt and Syria, observes, that though the whole of Palestine is almost an entire level plain, without either river or rivulet in summer, and only watered by the winter torrents, the soil is yet good, and may even be termed fertile: for when the winter rains do not fail, every thing springs up in abundance; and the earth, which is black and fat, retains moisture sufficient for the growth of grain and vegetables during the summer. More doera, sesamum, watemelons, and beans, are sown here than in any other part of the country. They also raise cotton, barley, and wheat; but though the latter be most esteemed, it is less cultivated, for fear of too much inviting the avarice of the Turkish governors and the rapacity of the Arabs.

Judea, in its largest sense, was divided into maritime and inland, as well as into mountainous and champaign; and again subdivided into Judea on this side, and Judea beyond Jordan. But the most considerable division is that which was made among the twelve tribes, by lot, to prevent all murmuring and discontent among that stubborn people*; of these, two and a half were seated beyond Jordan, and the rest on this side. The next remarkable was made by King Solomon, who divided his kingdom into twelve provinces or districts, each under a peculiar officer; and every one of these was to supply the king with provisions for his household in his turn; that is, each for one month in the year †. But the most fatal division of all was that which obtained under his imprudent son Rehoboam, when ten of the twelve tribes revolted, under the conduct of Jeroboam, who became head of this new monarchy, styled *the kingdom of Israel*, in opposition to that of *Judah*, the title which distinguished the maimed kingdom of Rehoboam from that time downwards. Under the second temple the distinction lasted a considerable time, and the same bloody hatred and hostilities continued between these two kingdoms; that of Israel taking the name of *Samaria* from its capital. The inhabitants were a mixture of the old Israelites, and of new colonies sent thither by the kings of Assyria after their conquest of it, till they were subdued by the Maccabees, and their metropolis destroyed. Under the Romans it began to be divided into tetrarchies and toparchies: the larger were those of Judea, Samaria, and Galilee, Upper and Lower; the lesser, those of Geraritica, Sarona, and others of less note; all which lay on this side of the Jordan. The rest, on the

* *Josh.* xiv. 2. &c.

† 1 *Kings*, iv. 7. &c.

the other side, were those of Gilead Peræa, Gaulonitis, Auranitis, Batanea, and Decapolis. Josephus mentions * another division made in Gabinius's time into five districts, or, as he styles them, συνεδρια or *councils*, agreeable to the Roman manner: these were Jerusalem, Jericho, and Sephoris, on this side Jordan; and Gadaris and Amatheus on the other. In the reigns of the Christian emperors, it was divided afresh into Palestina Prima, Palestina Secunda, and Palestina Tertia or Salutaris; which last included the far greater part, if not the whole country, as is known to all who are acquainted with history. On that account we shall wave all other divisions and changes that happened to it under the northern barbarians, Saracens, &c. and conclude this article with the present state and division of it under the Turks.—The whole country of Palestine is now reduced to a district or province, under the beglerbegate or bassaship of Sacham or Damascus, who hath the seven following sangiacs or subgovernors under him, styled, according to the different places of their residence, 1. The sangiac of Damascus, who is under the bashaw of that province; 2. Of Jerusalem, or, as the Turks call it, *Cudjembaric* or *Coudscherif*; 3. Aglum; 4. Bahara; 5. Scifat; 6. Gaza; 7. Nabolos. Each of these has a number of ziamets, and each ziamet a number of timariots under them; for the better understanding of which terms, we shall refer our readers to Sir Paul Rycaut's account of the Ottoman empire. At present it will be sufficient to say of these inferior subdivisions, under the sangiac of this district, or sangiacate of Jerusalem, that it hath nine of the former and sixteen of the latter class. Neither must the reader imagine these sangiacates or sub-governments to be any thing considerable, or the residence of these officers to be places of any note or opulence. The former indeed live by oppressing the people under them, and extort contributions of every thing that comes within their reach, such as the protection of travellers, merchants, and caravans; but being all under their respective bashas, who are still more griping than their underlings, they are commonly fleeced of some considerable part of their unjust gains. As for the places of their residence, except it be here and there one in a considerable city, as at Damascus and Jerusalem, the rest are either some old cities or even inconsiderable villages.

* *Antiq.* lib. xiv.

There are a variety of curiosities in Palestine both natural and artificial; but they are so very numerous as almost to preclude description: we therefore refer our readers to the Ancient Universal History, vol. ii. where they are mentioned and particularly described. The principal mountains, rivers, and other places of note, have already been, or will be, noticed under their respective names.

PALESTRINA, a town of Italy, in the Campagna di Roma, with a bishop's see. It is the capital of a principality of the same name, and the bishop is one of the six cardinal bishops. It was anciently famous for the temple of Fortune, being then called *Præneste*, and seated on the top of a mountain, the ruins of which may yet be seen. E. Long. 12. 55. N. Lat. 41. 51.

PALESTRINA, is one of the largest and most populous of the islands called the Lagunes near Venice, and where the most considerable of the noblemen have houses of pleasure. It is 15,000 paces in length and 400 in breadth; the principal harbour has also the same name.

PALFREY, is one of the better sort of horses used by noblemen or others for state; and sometimes of old taken for a horse fit for a woman to ride. Camden says, that William Fauconberge held the manor of Cuckeny, in the county of Nottingham, in serjeantry, by the service of shoeing the king's palfrey when the king should come to Mansfield.

PALICAUD, or PALGATCHERRY, a fortress of considerable strength in India, which commands the passage between the two coasts of Malabar and Coromandel, by way of the Tritchinopoly and Coimbettore countries: there is also a communication with it through the Nayre country. It was held by the English; and was of great importance to them, when Coimbettore was in the hands of Tippoo, because, by our holding this place on the west, and Dindigul on the east of Coimbettore, that province was of little use to him in the time of war, without a very large force to protect it. But the fall of that sovereign, and the reduction of his territories, have effected a total change of circumstances. See Memoir of a Map of the Peninsula of India by Major Rennel.

PALICATE, a sea port town of India, on this side of the Ganges. It is seated on the coast of Coromandel, in the kingdom of Carnate, 70 miles north of Fort St George. Here the Dutch had a factory, and fort called the *Fort of Guelderland*. E. Long. 80. 1. N. Lat. 13. 34.

PALICI, or PALISCI, in *Fabulous History*, two deities, sons of Jupiter by Thalia, whom Æschylus, according to Macrobius, calls *Ætna*, in a tragedy which is lost. The nymph Ætna, when pregnant, begged Jupiter to remove her from the pursuit of Juno. Upon which he concealed her in the bowels of the earth; and when the time of her delivery arrived, the earth opened and brought into the world two children, to whom were given the name of *Palici*, απο του παλιν ικεσθαι, *because they came again into the world from the bowels of the earth*. These deities were worshipped with many ceremonies by the Sicilians; and near their temple were two small lakes, which were supposed to have sprung out of the earth when they were born. Near those pools it was usual to take the most solemn oaths when any body wished to decide controversies and quarrels. If any of the persons who took the oaths were perjured, they were immediately punished supernaturally; and those whose oath, by the deities of the place, was sincere, departed unhurt. The Palici had also an oracle, which was consulted upon some great emergencies, and which rendered the truest and most unequivocal answers. In a superstitious age, the altars of the Palici were stained with the blood of human sacrifices; but this barbarous custom did not last long, as the deities were satisfied with the usual offerings.

PALINDROMUS, a verse or sentence which runs the same when read either backwards or forwards. Such is the verse,

Roma tibi subito motibus ibit amor.

Some people of leisure have refined upon the Palindromus, and composed verses, each word of which is the same backwards as forwards; for instance, that of Camden:

Odo tenet mulum, madidam mappam tenet Anna.
Anna tenet mappam madidam, mulum tenet Odo.

PALINGENESIA, among divines, the same with regeneration. Among the older chemists, it denotes the producing of a body from its principles.

PALINGENIUS,

PALINGENIUS, Marcellus, an Italian poet, well known by a poem divided into 12 books, and entitled *Zodiacus Vitæ*, which he was several years in composing, and dedicated to Hercules II. of Este, duke of Ferrara. Some say he was a physician to that prince: others rank him among the learned Lutherans, to whom the duchess of Ferrara gave a reception in her court, and honoured with her protection. His *Zodiac* contains good things, and is a philosophical satire against immorality and false prejudices. Of the author's life, however, but little is known. He died some time between the years 1537 and 1543.

PALINODY, a discourse contrary to former avowed principles; hence the phrase of *palinodiam canere* was taken for a recantation.

PALINURI promontorium (Virgil, Velleius), with a cognominal port, was situated at the south extremity of the Sinus Pæstanus on the coast of Lucania: so called from Palinurus, Æneas's steersman, who there perished (Mela, Dionysius Halicarnasseus.)

PALINURUS, in *Fabulous History*, Æneas's pilot, whose fate Virgil very particularly describes. He fell into the sea when asleep; and was three days exposed to the tempests and its agitation, and at last came safe ashore, when the cruel inhabitants of the place murdered him to get his clothes. His body was left unburied on the sea shore: and since, according to the religion of the old Romans, no one could cross the Stygian lake before 100 years were elapsed, if his remains had not been decently buried, we find Æneas, when he went down to hell, speaking to Palinurus, and assuring him, that though his bones were deprived of a funeral, yet the place where his body was exposed should soon be adorned with a monument, and bear his name; and accordingly a promontory was called *Palinurus*.

PALISADES, in fortification, stakes made of strong split wood, about nine feet long, six or seven inches square, three feet deep in the ground, in rows about two and a half or three inches asunder, placed in the covert way, at three feet from, and parallel to, the parapet or side of the glacis, to secure it from surprise. They are also used to fortify the avenues of open forts, gorges, half moons, the bottoms of ditches, and in general all posts liable to surprise. They are usually fixed perpendicularly, though some make an angle inclining towards the ground next the enemy, that the ropes cast over them to tear them up may slip off.

Turning Palisades; an invention of M. Coehorn, in order to preserve the palisades of the covert way from the besiegers shot. They are so ordered, that as many of them as stand in the length of a rod, or about ten feet, turn up and down like traps, so as not to be in sight of the enemy till they just bring on their attack; and yet are always ready to do the proper service of palisades.

PALISSE, in *Heraldry*, a bearing like a range of palisades before a fortification, represented on a fesse, rising up a considerable height, and pointed a-top, with the field appearing between them.

PALIURUS, in *Botany*. See Rhamnus, Botany *Index*.

PALL, in *Heraldry*, a figure like a Greek γ, about the breadth of a pallet; it is by some heralds called a *cross pall*, on account of its being looked upon as an archiepiscopal bearing.

PALLA, in Roman antiquity, a mantle which women wore over the gown called *stola*. It was borne on the left shoulder; whence passing to the other side, under the right arm, the two ends were bound under the left arm, leaving the breast and arm quite bare. It had a great many folds, and derived its name from παλλω, to *shake* or *tremble*.

PALLADIO, Andrea, a celebrated Italian architect of the 16th century, was a native of Vicenza in Lombardy, and the disciple of Trissin. He made exact drawings of the principal works of antiquity in Rome, adding commentaries to them, which went through several impressions. But this, though a very useful work, was greatly exceeded by the Treatise of Architecture in four books, which he published in 1570. Inigo Jones wrote some excellent remarks on it; which were included in an edition of Palladio, published by Leoni, in two vols. folio, 1741.

PALLADIUM, in antiquity, a statue of the goddess Pallas. It was about three cubits high, and represented the goddess sitting and holding a pike in her right hand, and in her left a distaff and a spindle. It fell down from heaven near the tent of Ilus, as he was building the citadel of Ilium. Some, however, suppose, that it fell at Pessinus in Phyrgia; or, according to others, Dardanus got it as a present from his mother Electra. There are some who maintain, that the palladium was made with the bones of Pelops by Abaris; but Apollodorus says, that it was no more than a piece of clockwork which moved of itself. However various the opinions of ancient authors be about this celebrated statue, it is universally allowed, that on its preservation depended the safety of Troy. This fatality the Greeks, during the Trojan war, were well aware of; and therefore Ulysses and Diomedes were commissioned to steal it. This they effected; and if we can rely upon the authority of some, they were directed how to carry it away by Helenus, a son of Priam, who in this betrayed his country, because his brother Deiphobus, at the death of Paris, had married Helen, of whom he was enamoured. Minerva was enraged at the violence offered to her statue; and, according to Virgil, the palladium itself seemed to have received life and motion; and by the flashes which started from its eyes, and sudden springs from the earth, it seemed to show the resentment of the goddess. The true palladium, as is observed by some, was not carried away from Troy by the Greeks, but only a statue of similar size and shape, which was placed near it, to deceive whatever sacrilegious persons attempted to steal it. The palladium, therefore, as they maintain, Æneas conveyed safe from Troy to Italy, and it was afterwards preserved by the Romans, with the greatest secrecy and veneration in the temple of Vesta; a circumstance which none but the vestal virgins knew. It was esteemed the destiny of Rome; and there were several others made perfectly like it, to secure it from being stolen, as was that of Troy, which the oracle of Apollo declared should never be taken so long as the palladium was found within its walls. A palladium was also placed by Nicias in the citadel of Athens.

Palladium, one of the newly discovered metals, which is found alloyed with platina. See Chemistry *Index*, and Ores, *Reduction of*, under *Platina*.

PALLADIUS, bishop of Helenopolis in Bithynia, and then of Aspona. He was a Galatian, and born at Cappadocia.

Cappadocia. He became an anchorite in the mountain of Nebria in 588, and was consecrated a bishop in 401. He was an intimate friend of St John Chrysostom, whom he never forsook during the time of his persecution, nor even in his exile. He went to Rome some time after Chrysostom's death, and at the request of Lausus governor of Cappadocia, composed the history of the Anchorites or Hermits, and entitled it *Lausiaca*, after the name of that lord, to whom he dedicated it in 420, when it was written, being then the 20th year of his episcopacy, and 53d of his age. Palladius was accused of being an Origenist. It is true, he was an enemy to St Jerome, of whom he does not speak well, and was intimately connected with Ruffinus; but perhaps no good proof can be brought of his Origenism. He had been the disciple of Evagrias of Pontus, and was even suspected of entertaining the sentiments of Pelagius. He died in the 5th century, but in what year is not certain. His History was published in Greek by Meursius at Amsterdam in 1619, and in Latin in the *Bibliotheca Patrum;* but he seems not to have been the writer of the Life of St John Chrysostom in Greek and Latin, by M. Bigot, printed in 1680.

PALLAS, a freed man of Claudius, celebrated for the power and the riches which he obtained. He advised the emperor his master to marry Agrippina, and to adopt her son Nero for his successor. It was through him and Agrippina that the death of Claudius was hastened, and that Nero was raised to the throne. Nero, however, forgot to whom he was indebted for it. He discarded Pallas, and some time after caused him to be put to death, that he might procure his great riches.

PALLAS, a small planet lately discovered, and belonging to the solar system. See PLANET.

PALLAVICINI, FERRANTE, an Italian writer, descended from a noble family in Placentia, was born about the close of the 16th century. He soon gave proofs of an extraordinary genius, and quickly improved in classical erudition. He was afterwards sent to complete his education in the monastery of Augustine friars at Milan, where he took the habit, lived much esteemed for piety and learning, and raised great expectations of future fame; but being somewhat amorously inclined, he engaged in an intrigue with a young courtezan of Venice, whose charms proved irresistible; and in order to enjoy them without restraint, he obtained leave from his general to make the tour of France. Accordingly, he pretended to set out for that country; but it was only a blind to cover his real design. He never left Venice, but lived there privately, enchanted in the arms of his Venus: and having too ready a talent at invention, he imposed upon his friends by often sending them in letters feigned accounts of his travels through France; also informing them of several things respecting that court, which he learned from the advices of many considerable persons with whom he corresponded.

His finances were in the mean time greatly reduced; and in this exigence he naturally had recourse to his wits for supplies. He wrote for the booksellers; and composed several pieces, more for the sake of lucre than out of fondness for authorship. Among other things, he wrote a collection of letters, mostly satirical, which he called *The Courier Robbed of his Mail.* The work appeared at first in such a cast, as could not give great offence except to the Spaniards, against whom he had some grudge. The piece was accordingly licensed by the inquisitors; but falling into the hands of the secretary of the republic of Venice, who at that time was licenser of books, he would not give his imprimatur, though great interest was employed for that purpose, neither would he return the manuscript. This enraged Pallavicini so much, that had not his friends restrained him, he would have pursued the affair to his ruin.

At length he found an opportunity of travelling into Germany with the duke of Amalfi, as his chaplain. This journey, as was to be expected, had no good effect either upon his wit or his morals. On the contrary, finding himself, from the manners of the Germans, more at liberty, he indulged his genius and passions with greater ease; and after a residence there of upwards of a year with the duke, he returned to Venice. He was now resolved to have his full measure of revenge against the secretary of the republic for keeping his manuscript; and with him his resentment joined the family of Barberini, Pope Urban VIII. and his nephews, because they also endeavoured, at the instigation of the Jesuits, to get all his manuscripts forbid the press. In this rancorous spirit he cast his Courier into a new model, and enlarged it with many letters and discourses. Thus new modelled, he offered it to a bookseller, who undertook to get it printed; but our author was betrayed by a pretended friend; who acted the part of a spy, and informed the archbishop of Vitelli, then the pope's nuncio at Venice, just as the work was finished at the press: at the same time, this treacherous friend bought the whole impression; and upon the nuncio's complaint, Pallavicini was imprisoned. In this miserable condition he found a friend in one of his mistresses, who, seeing him abandoned by most of his patrons, not only supported him, but conveyed letters to him, by which she gave him such information as enabled him to make a proper defence, and to recover his liberty.

But a war having in the mean time broken out between the Barberini and the duke of Parma; Pallavicini, in order to revenge himself upon the supposed instruments of his imprisonment, wrote a piece entitled "The tinkling Instrument to call together the Barberini Bees;" and dedicated it in terms of the profoundest contempt to the nuncio Vitelli. The nuncio finding that little notice was taken of his complaints on the occasion, procured by bribery one Charles Morfu, a Frenchman of infamous character, who pretended to pass for a gentleman, to ensnare Pallavicini: to which end, the traitor used his best endeavours to insinuate himself into his friendship, and at length exhorted him to accompany him to France. He declared that his fortune would be made by the extraordinary encouragement which was given to men of letters by Cardinal Richelieu: and the better to favour the deceit, he produced feigned letters from the Cardinal, inviting our author to France, and expressing a desire he had to establish in Paris an academy for the Italian tongue, under the direction of Pallavicini. The snare took; and now, fascinated by the prospect of gain, Pallavicini suffered himself to be led like an ox to the slaughter, whithersoever Morfu thought proper. He left Venice much against the advice of his friends, and went first to Bergamo, where he spent a few

few days with some of his relations, by way of giving some entertainment to Morfu. They then set off for Geneva, to the great satisfaction of our author, who proposed to get some of his works printed there, which he had not been able to do in Italy. Morfu, however, instead of conducting him to Paris, took the road to Avignon; where, crossing the bridge of Soraces, in the county of Venaissin, they were seized by a gang of *sbirri*, or sheriff's officers, on pretence of carrying contraband goods, and confined. Morfu was quickly discharged, and very liberally rewarded; but Pallavicini, being carried to Avignon, was imprisoned; and notwithstanding, on his examination concerning some papers found upon him, he made a very artful defence, it was in vain. The sentence was already brought from Rome, and he was to undergo a trial merely for form's sake. For this purpose being put into a dark dungeon, he made another effort to escape. He managed matters so well with his keeper, as to procure wax candles to be allowed him, under pretence of amusing himself with reading, and when he had got a number of these, he set fire one night to the prison door, in order to get off by that means; but the stratagem did not succeed, and he was of course confined much closer and treated with great inhumanity. After a year's suffering, he was brought to trial, in which he made an excellent defence, and flattered himself with hopes of relief. He had even begun a whimsical piece on the subject of melancholy; but, contrary to his expectations, he was sentenced to die, and lost his head on a scaffold in the flower of his age.

He was of so heedless and profuse a disposition, that had he possessed an immense estate he would have spent it all. He was never engaged in a virtuous passion, being inflamed to a prodigious and unnatural degree with the love of the meanest and most infamous prostitutes. On the other hand, no one could be more sincere and faithful in his friendships, nor was ever a man a greater prey to treachery; insomuch that, when released from prison in Venice, he was told that a wretch had betrayed him, he could not be prevailed upon to believe it, saying, "How can this be, since he declared himself my friend, and I made him privy to all my concerns!" He used, while he wore a religious habit, to study or write two or three hours in bed every morning. The rest of the day he spent either in the company of idle persons, or else with the ladies: but after he had wholly left the monastic life, upon pretence of securing himself from the snares of his enemies, he lived in a very irregular manner. He was possessed of a fine genius, had a great facility in writing; and till he was corrupted by the commerce of mean lewd women, he wrote pieces worthy of immortality. He did not spend much time or pains either in composition or in revision, for he frequently sent to the press the very first exertions of his genius; yet nature had given him so noble a vein of eloquence, which he had greatly improved by perusing the best authors, that his first thoughts were often equal to the most laboured compositions. He was modest, and spoke of himself with diffidence: but his works are strongly tinctured with envy, malice, and gall. He made but a poor figure in conversation; and when with persons of worth and distinction, would often retire to a corner of the room, and seem quite wrapt up in thought. He never exerted his wit and humour after his return from Germany, but when he was in the company of some mean women. Upon the whole, it is difficult to determine whether vice or virtue was the most predominant feature in his character. His death gave birth to a dialogue, entitled, *Anima erranti di Ferrante Pallavicini*, or, "The wandering Ghost of Pallavicini." Besides his life at the head of his works in two volumes, there is another prefixed to the "Divortio celeste," at Amsterdam, 1696.

PALLENE, a small peninsula of Thrace or Macedonia, formerly called *Phlegra*. It is situated near the bay of Thermæ, and contains five cities, the principal of which is called *Pallene*. It was famous, according to some of the ancients, for an engagement between the gods and the giants.

PALLET, among painters, a little oval table, or piece of wood or ivory, very thin and smooth; on and round which the painters place the several colours they have occasion for, to be ready for the pencil. The middle serves to mix the colours on, and to make the tints required in the work. It has no handle, but, instead thereof, a hole at one end to put the thumb through to hold it.

PALLET, among potters, crucible makers, &c. a wooden instrument, almost the only one they use, for forming, beating, and rounding their works. They have several kinds: the largest are oval, with a handle; others are round, or hollowed triangularly; others, in fine, are in manner of large knives, serving to cut off whatever is superfluous on the moulds of their work.

PALLET, in gilding, an instrument made of a squirrel's tail, to take up the gold leaves from the pillow, and to apply and extend them on the matter to be gilt. See GILDING.

PALLET, in *Heraldry*, is nothing but a small pale, consisting of one half of it in breadth, and therefore there are sometimes several of them upon one shield.

PALLET, is also a part belonging to the balance of a watch or movement. See the article WATCH.

PALLIATÆ, a name which the Romans gave to such plays as laid the plot in Greece, and required the performers to appear in Grecian habits. It is used in contradistinction to *togatæ*, in which the scene was laid at Rome, and in which the dresses were Roman. The word palliatæ is derived from *pallium*, which was a part of dress peculiar to the Greeks; whereas the toga belonged to the Romans only. See TOGATÆ, COMEDY, &c.

PALLIATION, or a PALLIATIVE *Cure*, in *Medicine*, is when, in desperate and incurable diseases, after predicting the fatal event, the physician prescribes some remedies for mitigating the pain or some other urgent symptoms, as in ulcerated cancers, or cancerous fistulas, and the like.

PALLIO COOPERIRE. It was an ancient custom, where children were born out of lawful wedlock, and their parents were afterwards married, that those children, together with the father and mother, should stand *pallio cooperti*, under a cloth, while the marriage was solemnizing; which was a kind of adoption, and had the effect of a legitimation. Thus Robert Grosthead, the famous bishop of Lincoln, in one of his letters says: *In signum legitimationis, nati ante matrimonium consueverunt*

verunt poni sub pallio *super parentes eorum extento in matrimonii solemnizatione.*

Selden, in his notes on Fleta, adds, that the children of John of Gaunt, duke of Lancaster, by Catherine Swinford, though legitimated by act of parliament, yet were *covered with the pall* when the parents were married.

PALLIUM, a word often mentioned in our old historians. Durandus tells us, that it is a garment made of white wool, after the following manner, viz. The nuns of St Agnes, every year, on the feast day of their saint, offer two white lambs on the altar of their church, during the time they sing *Agnus Dei*, in a solemn mass; which lambs are afterwards taken by two of the canons of the Lateran church, and by them given to the pope's subdeacons, who send them to pasture till shearing time, and then they are shorn, and the pall is made of their wool mixed with other white wool. The pall being thus made, is carried to the Lateran church, and there placed on the high altar, by the deacons of that church, on the bodies of St Peter and St Paul; and after an usual watching, it is carried away in the night, and delivered to the subdeacons, who lay it up safe. And because it was taken from the body of St Peter, it signifies the plenitude of ecclesiastical power: and therefore it was the prerogative of popes, who pretend to be the immediate successors of that saint, to invest other prelates with it; which at first was done nowhere but at Rome, though afterwards at other places.

Pallium, in antiquity, an upper garment or mantle worn by the Greeks, as the toga was by the Romans. Each of these was so peculiar to the respective nations, that *Palliatus* is used to signify a Greek, and *Togatus* a Roman.

PALM, has among almost all nations been regarded as an emblem of victory, and assigned as the reward of it. The reason why this tree was adopted, and made use of to represent victory, is said to be, because it is so elastic, that if pressed by the greatest weight, it will rise superior to the pressure, and be able to restore itself to its former state, appearing almost invincible.

Palm-Sunday, in the Christian church, the Sunday next before Easter; being so called in memory of our Saviour's triumphal entry into Jerusalem, when the multitude that attended him strewed branches on his way.

The ancients had other names for this day. For, 1. They called it *Dominica Competentium*, i. e. Sunday of the Competentes; because on that day the catechumens came to ask the bishop leave to be admitted to baptism, which was conferred the Sunday following. They had also then given them the symbol or credo, to get off by heart, to be repeated to the bishop in the ceremony of baptism. 2. They called it *Capitiluvium*, the Sunday of washing the head; because those that were to be baptized the following Sunday were prepared by washing their heads on this day. Some time afterwards they called it *Indulgence Sunday*, because the emperors and patriarchs used to distribute gifts on that day.

Palm-Tree. See Phoenix, Botany *Index*.

PALMA, or *Palma Nova*, a very strong town of Italy, in Friuli, in the territory of Venice. It is a very important place, for the defence of the Venetians against the Austrians and Turks; and was built in 1593, for that very purpose. They have cut a canal near this place, which is very advantageous. It is seated on the sea side, 10 miles south-east of Udino, and 55 north-east of Venice. East Long. 13. 15. North Lat. 46. 2.

Palma, an island in the Atlantic ocean, and one of the Canaries, 56 miles north-west of Gomera, and about 75 in circumference. It abounds in wine and sugar; and has a handsome town of the same name, which carries on a trade in wine to the West Indies and other parts. Their best vines grow in a soil called the *Brenia*, where they make 12,000 butts of wine every year, which is well known by the name of *palm wine*. There is plenty of cattle, and all sorts of fruits. In 1625 a volcano broke out in this island, with a most violent earthquake; the flame was seen for six weeks together, and a great quantity of ashes were thrown as far as Teneriffe. It was conquered by the Spaniards in 1460.

PALMÆ, *Palms*. Under this name Linnæus has arranged several genera, which, although capable of a place in separate classes of his system, he chooses rather, on account of their singular structure, to place apart, in an appendix to the work.—See Botany *Index*.

The same plants constitute one of the seven families or tribes into which all vegetables are distributed by Linnæus in his *Philosophia Botanica*. They are defined to be plants with simple stems, which at their summit bear leaves resembling those of the ferns, being a composition of a leaf and a branch; and whose flowers and fruit are produced on that particular receptacle or seat called a *spadix*, protruded from a common calyx in form of a sheath or scabbard, termed by Linnæus *spatha*.

Palmæ is likewise the name of the first order in Linnæus's Fragments of a Natural Method.

PALMARIS muscle, in *Anatomy*. See there, *Table of the Muscles*.

PALMATED, something resembling the shape of the hand: thus we say, palmated leaves, roots, stones, &c.

PALMERSTON'S Island, situated in the South Seas, which Captain Cook visited in his second and last voyages. It consists of a group of small islets, nine or ten in number, connected by a reef of coral rocks, and lying in a circular direction. It admits of no anchorage, nor are there any inhabitants on it, though it abounds with cocoa nuts, scurvy grass, and the wharra tree. This island is not more than a mile in circumference, and is not elevated above three feet above the level of the sea. It consists entirely of a coral sand, with a small mixture of blackish mould, which appeared to be produced from rotten vegetables. "At one part of the reef (say our navigators), which bounds the lake within, almost even with the surface, there was a large bed of coral, which afforded a most enchanting prospect. Its base, which was fixed to the shore, extended so far that it could not be seen, so that it appeared to be suspended in the water. Even this delightful scene was greatly improved by the multitude of fishes that gently glided along, seemingly with the most perfect security. Their colours were the most beautiful that can be imagined, blue, yellow, black, red, &c. far excelling any thing that can be produced by art. The

richness

Palmerston's Island || Palmyra.

richness of this submarine grotto was greatly increased by their various forms; and the whole could not possibly be surveyed without a pleasing transport, accompanied at the same time with regret, that a work so astonishingly elegant should be concealed in a place so seldom explored by the human eye." E. Long. 196. 35. S. Lat. 18. 8.

PALMIPEDES, among ornithologists, the same with web-footed birds. See ORNITHOLOGY.

PALMISTRY, a kind of divination, or rather a deceitful art practised by gypsies, who pretend to foretel events by looking upon the lines and marks of the hand.

PALMUS, a long measure used both by the Greeks and Romans. The Grecian palmus was of two sorts; the greater, which contained nine finger breadths, and the less which contained four. The Roman palmus was also of two sorts; the greater, which contained twelve finger breadths, or eight inches and a half English; and the less, which contained four finger breadths, or near three inches English.—The great palmus was taken from the length of the hand or span; the less from the breadth of it. The Greek palmus was called *doran*. See MEASURE.

PALMYRA, or TADMOR, a noble city of ancient Syria, now in ruins, the origin of whose name is uncertain. Neither is it well known by whom this city was built; for though, from the identity of the names, it is thought by many to have been the *Tadmor in the wilderness* built by Solomon *, this point, however, is much controverted by many learned men. For the world have been long and justly astonished to find in the desert of Syria, at a distance from the sea, with a very precarious and scanty supply of water only, and without a particular connexion with any great monarchy, ruins of a city more extensive and splendid than Rome itself, the depositary of all the arts which Greece in its most flourishing periods could afford. The problem is an intricate one; yet when we divest it of many of its difficulties, we shall bring this stupendous prodigy to no very uncommon magnitude. The coast of Syria was in very early ages rich and populous; and either from the conveniency of procuring water, or from the vicinity of India and Egypt, the population, instead of increasing on the mountains, extended to Judea, and from thence through its plains only to the internal parts. The ruins of this numerous people, and of their habitations, remain; but as their edifices were not uncommonly splendid, or, as the causes of their destruction were powerful, they have not attracted much attention. Yet the ruins of more than 30 towns are discoverable to the south-east of the Dead Sea, and from thence towards Tadmor or Palmyra; we know the cause of the destruction of these towns, and we know that it did not reach Palmyra. This splendid city was not, therefore, insulated in a mass of sand: it was probably a link of a continued chain of population, or perhaps its termination. The situations of towns in the sandy desert must necessarily be determined by local advantages. Tadmor is situated where two hills converge, and beyond the point where they approach. These hills afforded water, that necessary aid to animal life; and the aqueducts through which it was brought from them were discovered and described by Mr Wood. Though the other towns now in ruins afford some remains of luxury and opulence, yet in these respects they are much inferior to Palmyra; and this deserves to be explained. Palmyra was undoubtedly very ancient. "The two springs of fresh water it possesses (says Volney *) were, above all, a powerful inducement in a desert everywhere else so parched and barren. These, doubtless, were the two principal motives which drew the attention of Solomon, and induced that commercial prince to carry his arms so remote from the limits of Judea." "He built strong walls there (says the historian Josephus), to secure himself in the possession, and named it *Tadmor*, which signifies the Place of Palm trees." Hence it has been inferred that Solomon was its first founder; but we should, from this passage, be rather led to conclude that it was already a place of known importance. The palm trees he found there are not the trees of uninhabited countries. Prior to the days of Moses, the journeys of Abraham and Jacob from Mesopotamia into Syria, sufficiently prove a communication between these countries, which must soon have made Palmyra flourish. The cinnamon and pearls mentioned in the time of the Hebrew legislator, demonstrate a trade with India and the Persian gulf, which must have been carried on by the Euphrates and Palmyra. At this distance of time, when the greater part of the monuments of these early ages have perished, we are liable to form very false opinions concerning the state of these countries in those remote times, and are the more easily deceived, as we admit as historical facts antecedent events of an entirely different character. If we observe, however, that men in all ages are united by the same interests and the same desires, we cannot help concluding, that a commercial intercourse must early have taken place between one nation and another, and that this intercourse must have been nearly the same with that of more modern times. Without, therefore, going higher than the reign of Solomon, the invasion of Tadmor by that prince is sufficient alone to throw a great light on the history of this city. The king of Jerusalem would never have carried his attention to so distant and detached a spot, without some powerful motive of interest; and this interest could be no other than that of an extensive commerce, of which this place was already the emporium. This commerce extended itself to India; and the Persian gulf was the principal point of union."

From the nature of the commodities, from the requisite assistance of the Tyrians, and other forcible arguments, M. Volney shows that the Persian gulf was the centre of the most ancient commerce of the eastern world; and that it was with a view of obtaining a shorter route, by means of the Euphrates, that Solomon turned his attention to Tadmor, distant but three days journey from it. Our author goes on, "We may even reasonably conjecture, when we reflect on the revolutions of the following ages, that this commerce became a principal cause of those various wars in Lower Asia, for which the barren chronicles of those early times assign no motives. If, after the reign of Solomon, the Assyrians of Nineveh turned their ambitious views towards Chaldea, and the lower part of the Euphrates, it was with the intention to approach that great source of opulence the Persian gulf. If Babylon, from being the vassal of Nineveh, in a short time became her rival, and the seat of a new empire, it was because her situation rendered her the emporium of this lucrative trade; in short, if the kings of this great city waged perpetual wars

* 1 Kings, ix. 18. and 2 Chron. viii 4. and Josephus, Ant. Jud. lib. i.

* Travels through Syria and Egypt.

wars with Jerusalem and Tyre, their object was not only to despoil these cities of their riches, but to prevent their invading their trade by the way of the Red sea. An historian who has informed us that Nabuchodonosor, before he laid siege to Jerusalem, took possession of Tadmor, clearly indicates that the latter city acted in concert with the two neighbouring capitals. Their gradual decline became, under the Persian empire, and the successors of Alexander, the efficient cause of the sudden greatness of Palmyra in the time of the Parthians and Romans; she then enjoyed a long peace for many centuries, which allowed her inhabitants to erect those monuments of opulence whose ruins we still admire." If the former observations showed the connection of this remote spot with a more populous country, these remarks explain the cause of the renovation, and of the magnificence of this city. Our author's remarks are at least probable, and are, in our opinion, very convincing. Cairo, in another, probably a subordinate route, never attained the splendour of Palmyra; but the genius of the Egyptians, perhaps the laws of Egypt, prevented it.

There is, however, no authentic history of Palmyra till after the captivity of the Roman emperor Valerian by the Persians. It is first mentioned by the Roman historians, as a place which Mark Antony attempted to plunder, upon pretence that it had not observed a just neutrality between the Romans and Parthians. Pliny takes notice of it as being situated in a rich soil, among pleasant streams, and totally separated from the rest of the world by a vast sandy desert, which had preserved its independence between Parthia and Rome. There is still a considerable spot of good soil next the town and on the hills; and even in the wilderness, there were palms and fig trees, some of which remained till the latter end of the 17th century, though not one is now to be found.

After the captivity of Valerian, it was become an opulent city, to which its situation in the vicinity of the Roman and Parthian empires greatly contributed; as the caravans, in going to or returning from the east, frequented the place, and thus rendered it a considerable seat of merchandise. It enjoyed an independency till the time of Trajan; who, having made himself master of almost all the Parthian empire, reduced Palmyra likewise, and it was afterwards accounted part of the Roman dominions. But when the defeat and captivity of Valerian had so much weakened the empire, that the Persians seemed to be in a fair way of becoming masters of all the eastern provinces, the Palmyrenians began to entertain thoughts of recovering their liberty. Odenathus, prince of Palmyra, sent a very respectful letter to Sapor on his return, accompanied with considerable presents; but by that haughty conqueror his letter and embassy were treated with the most provoking contempt. The presents were thrown into the Euphrates: and to his letter Sapor replied, That his insolence in presuming to write to his lord was inexcusable; but if he could atone for it in any way, it would be by presenting himself before the throne, bound hand and foot, in token of a consciousness of his crime, and the punishment he deserved. With this injurious treatment Odenathus was so provoked, that he swore either to bring down the pride of the haughty conqueror, or die in the attempt. Accordingly, having assembled what forces he could, he fell upon the Persians, destroyed a number of them, took a great part of their baggage, and some of the king's concubines. Of the war of Odenathus with the Persians, however, we know very little: only that though the latter were often vanquished, and the independency of Palmyra established for the present; yet Valerian was never released from his captivity, though Odenathus earnestly wished to have the honour of rescuing him from his enemies.

Odenathus enjoyed his sovereignty but a very short time; being murdered by his nephew, who was soon after put to death by Zenobia the wife of Odenathus. This lady is said to have been possessed of very extraordinary endowments both of body and mind, being, according to Mr Gibbon, almost the only Asiatic woman who is recorded to have overcome the obstacles arising from the confined situation of the fair sex in that part of the world. Immediately on taking vengeance for the murder of her husband, she assumed the government, and soon strengthened herself so much, that she resolved to submit neither to the Roman nor Persian power. The neighbouring states of Arabia, Armenia, and Persia, dreaded her enmity, and solicited her alliance. To the dominions of Odenathus, which extended from the Euphrates to the frontiers of Bithynia, his widow added the inheritance of her ancestors, the populous and fertile kingdom of Egypt. The emperor Claudius acknowledged her merit, and was content, that, while he pursued the Gothic war, she should assert the dignity of the empire in the east. The conduct, however, of Zenobia, was attended with some ambiguity; nor is it unlikely that she had conceived the design of erecting an independent and hostile monarchy. She blended with the popular manners of Roman princes the stately pomp of the courts of Asia, and exacted from her subjects the same adoration that was paid to the successors of Cyrus. She bestowed on her three sons a Latin education, and often showed them to the troops adorned with the imperial purple. For herself she reserved the diadem, with the splendid but doubtful title of *Queen of the east.*

When Aurelian passed over into Asia, against an adversary whose sex alone could render her an object of contempt, his presence restored obedience to the province of Bithynia, already shaken by the arms and intrigues of Zenobia. Advancing at the head of his legions, he accepted the submission of Ancyra: and was admitted into Tyana, after an obstinate siege, by the help of a perfidious citizen. The generous, though fierce temper of Aurelian, abandoned the traitor to the rage of the soldiers: a superstitious reverence induced him to treat with lenity the countrymen of Apollonius the philosopher. Antioch was deserted on his approach; till the emperor, by his salutary edicts, recalled the fugitives, and granted a general pardon to all who, from necessity rather than choice, had been engaged in the service of the Palmyrenian queen. The unexpected mildness of such a conduct reconciled the minds of the Syrians, and as far as the gates of Emesa, the wishes of the people seconded the terror of his arms.

Zenobia would have ill deserved her reputation, had she indolently permitted the emperor of the West to approach within 100 miles of her capital. The fate of the East was decided in two great battles; so similar in almost every circumstance, that we can scarcely distinguish

Palmyra. guish them from each other, except by observing that the first was fought near Antioch, and the second near Emesa. In both, the queen of Palmyra animated the armies by her presence, and devolved the execution of her orders on Zabdas, who had already signalized his military talents by the conquest of Egypt. The numerous forces of Zenobia consisted for the most part of light archers, and of heavy cavalry clothed in complete steel. The Moorish and Illyrian horse of Aurelian were unable to sustain the ponderous charge of their antagonists. They fled in real or affected disorder, engaged the Palmyrenians in a laborious pursuit, harassed them by a desultory combat, and at length discomfited this impenetrable but unwieldy body of cavalry. The light infantry, in the mean time, when they had exhausted their quivers, remaining without protection against a closer onset, exposed their naked sides to the swords of the legions. Aurelian had chosen these veteran troops, who were usually stationed on the Upper Danube, and whose valour had been severely tried in the Allemannic war. After the defeat of Emesa, Zenobia found it impossible to collect a third army. As far as the frontier of Egypt, the nations subject to her empire had joined the standard of the conqueror; who detached Probus, the bravest of his generals, to possess himself of the Egyptian provinces. Palmyra was the last resource of the widow of Odenathus. She retired within the walls of her capital; made every preparation for a vigorous resistance; and declared, with the intrepidity of a heroine, that the last moment of her reign and of her life should be the same.

In his march over the sandy desert, between Emesa and Palmyra, the emperor Aurelian was perpetually harassed by the Arabs; nor could he always defend his army, and especially his baggage, from those flying troops of active and daring robbers, who watched the moment of surprise, and derided the slow pursuit of the legions. The siege of Palmyra was an object far more difficult and important; and the emperor, who with incessant vigour pressed the attacks in person, was himself wounded with a dart. "The Roman people, (says Aurelian in an original letter), speak with contempt of the war which I am waging against a woman. They are ignorant both of the character and of the power of Zenobia. It is impossible to enumerate her warlike preparations, of stones, of arrows, and of every species of missile weapons. Every part of the walls is provided with two or three balistæ, and artificial fires are thrown from her military engines. The fear of punishment has armed her with a desperate courage. Yet I trust still in the protecting deities of Rome, who have hitherto been favourable to all my undertakings." Doubtful, however, of the protection of the gods, and of the event of the siege, Aurelian judged it more prudent to offer terms of an advantageous capitulation: to the queen, a splendid retreat; to the citizens, their ancient privileges. His proposals were obstinately rejected, and the refusal was accompanied with insult.

The firmness of Zenobia was supported by the hope that in a very short time famine would compel the Roman army to repass the desert; and by the reasonable expectation that the kings of the East, and particularly the Persian monarch, would arm in the defence of their most natural ally. But fortune, and the perseverance of Aurelian, overcame every obstacle. The death of Sapor, which happened about this time, distracted the Palmyra. councils of Persia; and the inconsiderable succours that attempted to relieve Palmyra were easily intercepted either by the arms or the liberality of the emperor. From every part of Syria a regular succession of convoys safely arrived in the camp, which was increased by the return of Probus with his victorious troops from the conquest of Egypt. It was then that Zenobia resolved to fly. She mounted the fleetest of her dromedaries; and had already reached the banks of the Euphrates, about 60 miles from Palmyra, when she was overtaken by the pursuit of Aurelian's light-horse, seized and brought back a captive to the feet of the emperor. Her capital soon after surrendered, and was treated with unexpected lenity. The arms, horses, and camels, with an immense treasure of gold, silver, silk, and precious stones, were all delivered to the conqueror; who, leaving only a garrison of 600 archers, returned to Emesa, and employed some time in the distribution of rewards and punishments at the end of so memorable a war, which restored to the obedience of Rome those provinces that had renounced their allegiance since the captivity of Valerian.

When the Syrian queen was brought into the presence of Aurelian, he sternly asked her, How she had presumed to rise in arms against the emperors of Rome? The answer of Zenobia was a prudent mixture of respect and firmness: "Because I disdained to consider as Roman emperors an Aureolus or a Gallienus. You alone I acknowledge as my conqueror and my sovereign." But as female fortitude is commonly artificial, so it is seldom steady or consistent. The courage of Zenobia deserted her in the hour of trial; she trembled at the angry clamours of the soldiers, who called aloud for her immediate execution; forgot the generous despair of Cleopatra, which she had proposed as her model; and ignominiously purchased life by the sacrifice of her fame and her friends. It was to their counsels, which governed the weakness of her sex, that she imputed the guilt of her obstinate resistance; it was on their heads that she directed the vengeance of the cruel Aurelian. The fame of Longinus, who was included among the numerous and perhaps innocent victims of her fear, will survive that of the queen who betrayed, or the tyrant who condemned him. Genius and learning were incapable of moving a fierce unlettered soldier, but they had served to elevate and harmonise the soul of Longinus. Without uttering a complaint, he calmly followed the executioner, pitying his unhappy mistress, and bestowing comfort on his afflicted friends.

Returning from the conquest of the East, Aurelian had already crossed the straits which divided Europe from Asia, when he was provoked by the intelligence that the Palmyrenians had massacred the governor and garrison which he had left among them, and again erected the standard of revolt. Without a moment's deliberation, he once more turned his face towards Syria. Antioch was alarmed by his rapid approach, and the helpless city of Palmyra felt the irresistible weight of his resentment. We have a letter of Aurelian himself, in which he acknowledges that old men, women, children, and peasants, had been involved in that dreadful execution, which should have been confined to armed rebellion; and although his principal concern seems directed to the re-establishment of a temple

Palmyra.

temple of the sun, he discovers some pity for the remnant of the Palmyrenians, to whom he grants the permission of rebuilding and inhabiting their city. But it is easier to destroy than to restore. The seat of commerce, of arts, and of Zenobia, gradually sunk into an obscure town, a trifling fortress, and at length a miserable village.

Little is known concerning the fortunes of Palmyra since the time of Mahomet, except that it was considered as a place of strength: and that in the 12th century there were 2000 Jews in it. With respect to the ruins, they appeared to be of two different and distinct periods; the oldest are so far decayed as not to admit of mensuration, and look as if they had been reduced to that state by the hand of time; the others appear to have been broken into fragments by violence. Of the inscriptions none are earlier than the birth of Christ, and none are later than the destruction of the city by Aurelian, except one, which mentions Dioclesian.

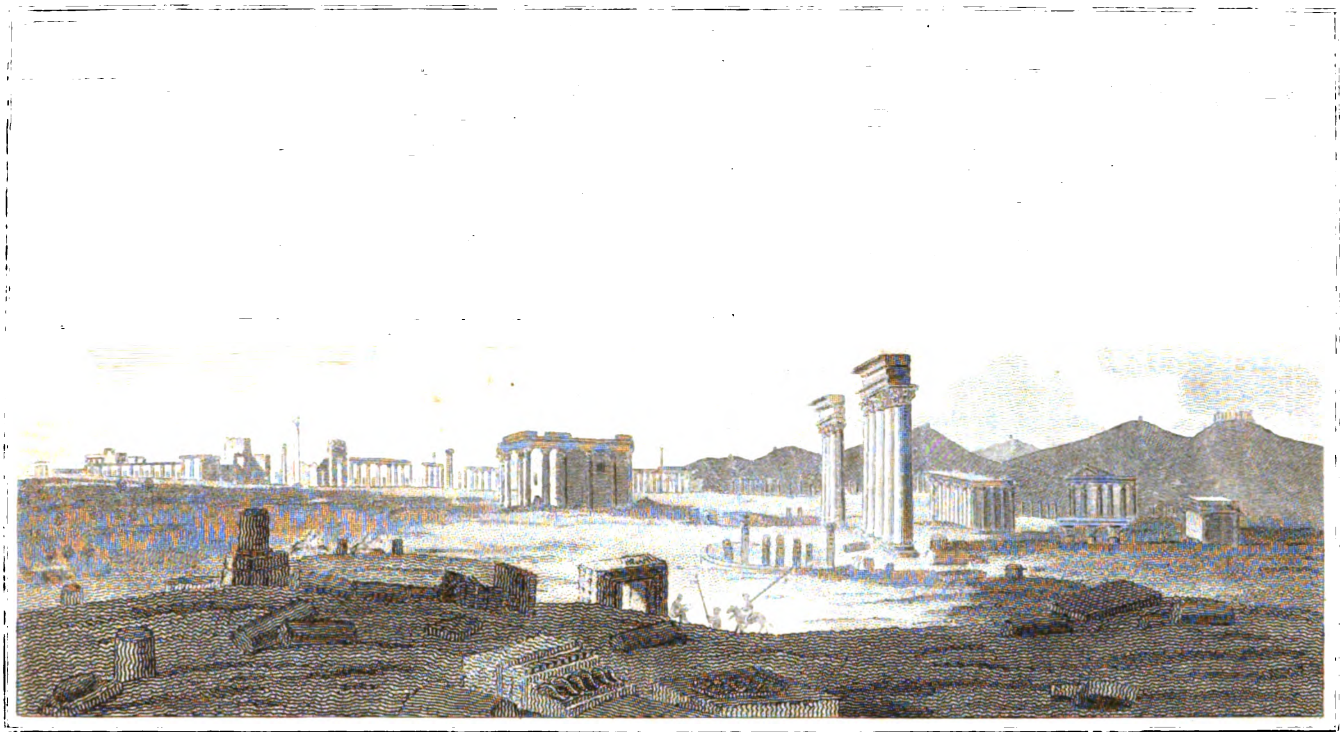
Mr Wood is of opinion, that the face of the country which surrounds Palmyra was always the same; but though Palmyra was always said to be situated in a wilderness, it does not follow that the wilderness was always of the same extent: It is perhaps more probable, that when Palmyra was first settled, the rich soil mentioned by Pliny extended much farther; for whatever were the reasons for making a settlement there, Palmyra can scarcely be supposed to have invited a greater number of people than it could feed. The palms and fig trees that were formerly found on the hills, and in the borders of the desert, that are now totally barren, confirm this opinion. Mr Wood observes, that while he was there a whirlwind happened, which took up such quantities of sand as quite darkened the sky; this sand therefore might by degrees encroach upon the fertile environs of Palmyra, and reduce the number of inhabitants as it reduced their sustenance, till the few wretched families only were left, who found it difficult to furnish food for Mr Wood and his company, though they did not continue longer than a fortnight among them. It will also appear from history, that what is supposed to have happened here has happened at other places, where such an event was much less probable. * On the sea coast in the neighhourhood of St Pol de Leon, in Lower Bretagne, there is a considerable tract of land which before the year 1666 was inhabited, but which was rendered uninhabitable by a sand, which, encroaching every year, covered it to the depth of above 20 feet. In the year 1718 it had advanced more than six leagues, and within one league of St Pol; so that it was then thought probable that the town would of necessity be abandoned. This sand is raised by the east or north-east wind, which drives it in clouds with great swiftness, and in a prodigious quantity. It was also attested by the captain of a ship, and all on board, that in the year 1719 there fell in the Atlantic ocean, at 15 degrees of north latitude, and at the distance of more than eight leagues from any land, a shower of sand, some of which they produced, and deposited in the academy at Paris †.

* *Memoirs of French Academy for* 1718.

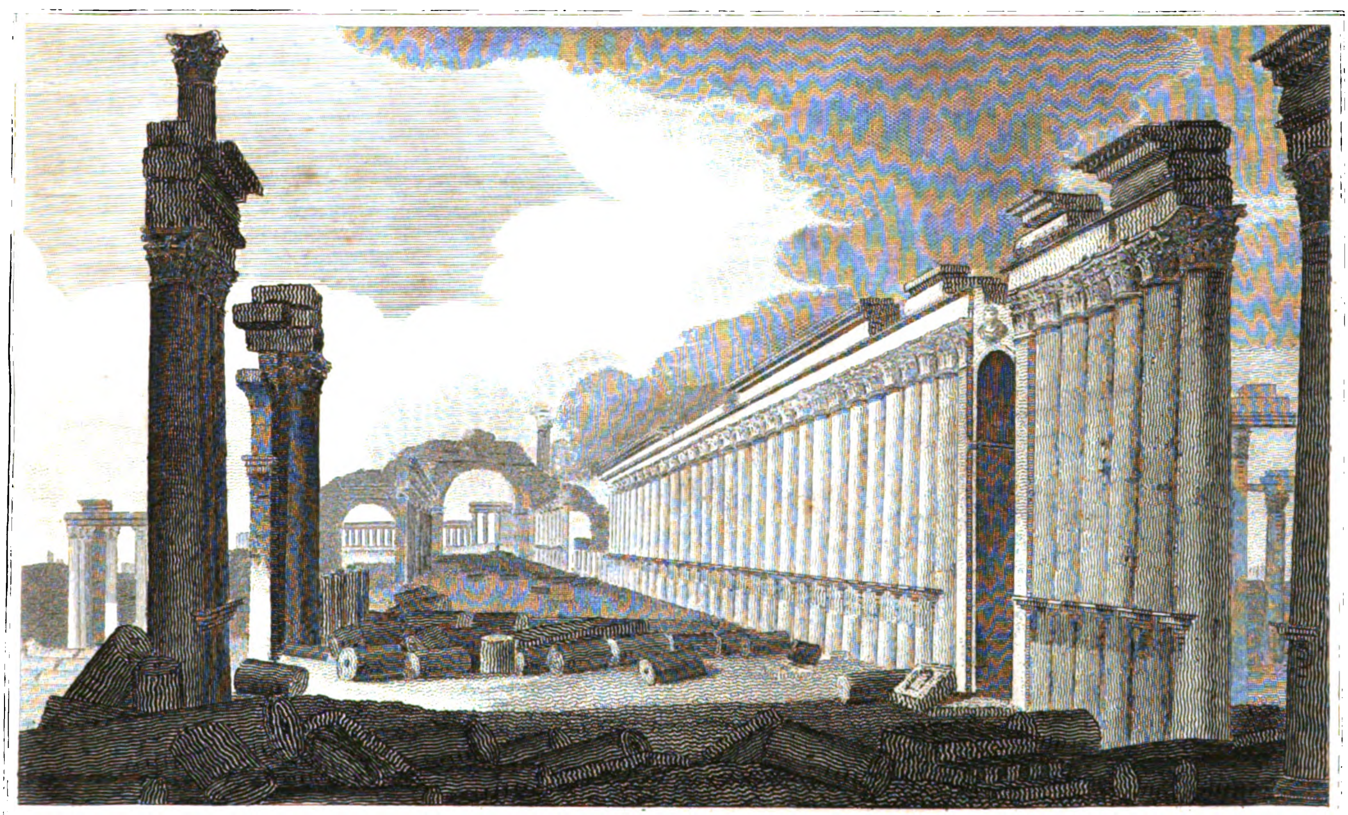
† *Hist. of the Acad.* 1772.

The company with whom Mr Wood, the publisher of the Ruins of Palmyra, travelled, arrived at length at the end of the plain, where a ridge of barren hills, by which it was divided on the right and left, seemed to meet; between them there was a vale, through which an aqueduct formerly conveyed water to Palmyra. On each side of this vale they remarked several sepulchres of the ancient Palmyrenes, which they had scarce passed, when the hills opening on a sudden, they discovered such piles of ruin as they had never seen. They were all of white marble; and beyond them, towards the Euphrates, was a wide level, stretching farther than the eye could reach, totally desolate, without variety, and without bounds. After having gazed some time upon this prospect, which rather exceeded than fell short of their expectations, they were conducted to one of the huts of the Arabs, of which there are about 30 in the court of the great temple. The inhabitants of both sexes were well shaped, and the women, though very swarthy, had good features. They were veiled, but did not so scrupulously conceal their faces as the eastern women generally do. They paint the ends of their fingers red, their lips blue, and their eyebrows and eyelashes black. They had large rings of gold or brass in their ears and nostrils, and appeared to be healthy and robust. The walls of the city are flanked by square towers, into which some ancient funeral monuments have been converted; but the walls are in most places level with the ground, and sometimes not to be traced. It is, however, probable, by their general direction, that they included the great temple, and are three miles in circumference. The Arabs showed a tract which was near ten miles in circumference; the soil of which was raised a little above the level of the desert: this, they said, was the extent of the old city; and that by digging in any part of it ruins were discovered.

These ruins consist of temples, palaces, and porticoes of Grecian architecture; and lie scattered over an extent of several miles. They were accidentally discovered by some English travellers from Aleppo somewhat more than a century ago. By far the most remarkable of them is the Temple of the Sun, of which the ruins are spread over a square of 220 yards. It was encompassed with a stately wall, built of large square stones, and adorned with pilasters within and without, to the number of 62 on a side. Within the court are the remains of two rows of very noble marble pillars 37 feet high, with their capitals of most exquisite workmanship. Of these only 58 remain entire; but there must have been many more, for they appear to have gone round the whole court, and to have supported a double piazza. The walks on that side of the piazza which is opposite to the front of the castle seem to have been the most spacious and beautiful. At each end of this line are two niches for statues, with their pedestals, borders, supporters, and canopies, carved with the utmost propriety and elegance. The space within this inclosure, which is now filled with the dirty huts of the inhabitants, seems to have been an open court, in the middle of which stood the temple, encompassed with another row of pillars of a different order, and much taller, being 50 feet high; but of these 16 only remain. The whole space contained within these pillars is 59 yards in length, and near 28 in breadth. The temple is no more than 33 yards in length, and 13 or 14 in breadth. It points north and south; and exactly into the middle of the building, on the west side, is a most magnificent entry, on the remains



The remains of the Great Temple of the Sun in PALMYRA from the West.



Engraved by W. & D. Lizars Edin.^r

Palmyra. mains of which are some vines and clusters of grapes, carved in the most bold and masterly imitation of nature that can be conceived. Just over the door are discerned a pair of wings, which extend its whole breadth; the body to which they belonged is totally destroyed; and it cannot now certainly be known whether it was that of an eagle or a cherub, several representations of both being visible on other fragments of the building. It is observed of the windows of this building, which were not large, that they were narrower at the top than below. The north end of the building is adorned with the most curious fret-work and bas-relief; and in the middle there is a dome or cupola about ten feet diameter, which appears to have been either hewn out of the rock, or moulded to some composition which by time is grown equally hard. North of this place is an obelisk, consisting of seven large stones, besides its capital and the wreathed work about it. It is about 50 feet high; and, just above the pedestal, is 12 feet in circumference. There was probably a statue upon it, which the Turks, in their zeal against idolatry, destroyed. At about the distance of a quarter of a mile from this pillar, to the east and west, are two others, besides the fragment of a third; so that perhaps they were originally a continued row.

About 100 paces from the middle obelisk, straight forward, is a magnificent entry to a piazza, which is 40 feet broad, and more than a half a mile in length, inclosed with two rows of marble pillars 26 feet high, and eight or nine feet in compass. Of these there still remain 129; and, by a moderate computation, there could not originally have been less than 560. The upper end of the piazza was shut in by a row of pillars, standing somewhat closer than those on each side. A little to the left are the ruins of a stately building, which appears to have been a banqueting-house. It is built of better marble, and is finished with yet greater elegance, than the piazza. The pillars which supported it were of one entire stone, which is so strong, that one of them which is fallen down has received no injury. It measures 22 feet in length, and in compass 8 feet 9 inches. In the west side of the piazza are several apertures for gates into the court of the palace. Each of these was adorned with four porphyry pillars, not standing in a line with those of the wall, but placed by couples in the front of the gate facing the palace, two on each side. Two of these only remain entire, and but one standing in its place. They are 30 feet long and 9 in circumference. On the east side of the piazza stands a great number of marble pillars, some perfect, but the greater part mutilated. In one place 11 are ranged together in a square: the space which they inclose is paved with broad flat stones, but there are no remains of a roof. At a little distance are the remains of a small temple, which is also without a roof, and the walls are much defaced. Before the entry, which looks to the south, is a piazza supported by six pillars, two on each side of the door, and one at each end. The pedestals of those in front have been filled with inscriptions both in the Greek and Palmyrene languages, which are become totally illegible. Among these ruins are many sepulchres: they are ranged on each side of a hollow way, toward the north part of the city, and extend more than a mile. They are all square towers, four or five stories high. But though they are alike in form, yet they differ greatly in magnitude and splendour. The outside is of common stone, but the floors and partitions of each story are marble. There is a walk across the whole building, just in the middle; and the space on each hand is subdivided into six partitions by thick walls. The space between the partitions is wide enough to receive the largest corpse; and in these niches there are six or seven piled upon one another.

Many inscriptions have been found at Palmyra, which have occupied much of the attention of the learned; and if any thing certain could be derived from them, there is no doubt but they would tend very considerably to the elucidation of ancient history. See Barthelemy's Reflections on the Palmyrene Alphabet, published at Paris in 1754; and An Explication of the Inscriptions at Palmyra hitherto published, by John Swinton of Christ-church, Oxford. See also Phil. Trans. N° 217. and 218.; the first volume of the Ancient Universal History; and, above all, consult the Ruins of Palmyra, or Tadmor in the Desert, published by Mr R. Wood, who, with M. Bouverie and Mr Dawkins, travelled thither in 1751. The result of their observations was published in 1753, in the form of an atlas. The ruins of this once mighty and celebrated city are represented in 57 copperplates, 16 by 12 inches, printed on imperial paper. They are admirably executed; the drawing is correct and masterly; and the engraving highly finished: nor can they fail to give satisfaction to those who are connoisseurs in the art, or to those who delight in the labours of antiquity. See Plate CCCCIII.

Palmyra was visited by Mr Bruce before his journey into Abyssinia; but, on account of the many publications concerning these celebrated ruins, he has declined saying much concerning them. He informs us, that before he came in sight of the ruins, he ascended a hill of white gritty stone, in a very narrow winding road, such as is called a pass; but on getting up to the top, his eyes were struck with the most stupendous sight which, he believes, ever mortal saw. The whole plain below, which is very extensive, was so covered with magnificent buildings, that they seemed to touch one another. All of them are finely proportioned, agreeably shaped, and composed of white stones, which at that distance appeared like marble. In taking a draught of these ruins, Mr Bruce divided the whole into six angular views, for which the situation of the place is very convenient. The columns are all uncovered to the very bases, the ground on which they are built being hard and solid. The views he took were upon large paper; some of the columns being represented a foot long, and some of the figures in the foreground of the Temple of the Sun (a magnificent building which stood at one end of the town) being near four inches. Before he left Palmyra he observed its latitude with a reflecting quadrant of Hadley; but as the instrument was out of order, he could not determine it exactly. In his opinion, however, 33° 58′ is not far distant from truth. From such observations as he could make on the longitude, he concluded it to be 37° 9′ east from Greenwich. Mr R. Wood makes the latitude 34° north.

From Palmyra Mr Bruce proceeded to Baalbec, distant about 130 miles, where he found ruins still more magnificent. The interior part of the great temple at this place, according to our author, surpasses any thing he had seen at Palmyra, or anywhere else. "All these views of Palmyra and Baalbec (says he) are now in the king's collection. They are the most magnificent offering, in their line, that ever was made by one subject to his sovereign."—In the neighbourhood of Palmyra are some salt-marshes; and to the adjacent country a trade is carried on in kelp from Tripoli in Syria. There are two Arab tribes, almost equally powerful; one of them, called Annecy, remarkable for the finest horses in the world.

Respecting the latitude and longitude there are still various opinions: that which appears to be nearest the truth is E. Long. 38. 50. N. Lat. 33. 20. It stands about 50 leagues south-east of Aleppo, as much from Damascus, and 20 leagues west of the Euphrates.

PALPABLE, something perceivable by the senses, particularly that of feeling.

PALPITATION *of the Heart*. See MEDICINE *Index*.

PALSY. See MEDICINE *Index*.

PALUDAMENTUM, in Roman antiquity, a habit that differed but little from the chlamys, except that this last belonged chiefly to the lower class of people. It was worn by the officers and principal men among the Romans in time of war, who are therefore called *Paludati;* which distinguished them from the common soldiers, who, because they wore the sagum, were called the *Sagati*. The paludamentum came down only to the navel, was open on the sides, had short sleeves resembling angels wings, and was generally white or red. It is sometimes used to signify the common soldier's coat.

PALUS MEOTIS, the ancient name of a gulf between Europe and Asia, to the north of the Black sea, now called the *sea of Zabach* or *Asoph*.

PALY, or PALE, in *Heraldry*, is when the shield is divided into four or more equal parts, by perpendicular lines falling from the top to the bottom.

PALY Bende, is when the escutcheon is divided by perpendicular lines, which is *paly;* and also by diagonals, which is called *bendy*.

PAMBOUK, the Turkish name of the ruined city of Hierapolis. See HIERAPOLIS.

PAMLICO SOUND, an inland sea on the east coast of the United States, about 80 miles long, and 20 or 30 broad. It is formed by a range of low sandy islands scarcely a mile broad, which stretch along the shores of North Carolina at a greater or less distance from the continent. Through these islands there are three inlets, the deepest of which has only ten feet water. They render the coast of North Carolina inaccessible to an enemy.

PAMPELUNA, the capital of the kingdom of Navarre in Spain, with a very strong citadel and rich bishopric. It is handsome and populous, and carries on a great trade, seated in a very fertile plain, in E. Long. 1. 25. N. Lat. 42. 42.

PAMPELUNA, a town of New Granda in South America, famous for its gold mines and numerous flocks of sheep. W. Long. 68. 30. N. Lat. 6. 30.

PAMPHILUS, a celebrated painter of Macedonia, in the age of Philip. He was founder of the school for painting at Sicyon; and he made a law which was observed not only in Sicyon but all over Greece, that none but children of noble and dignified persons should be permitted to learn painting. Apelles was one of his pupils.

PAMPHYLIA, the ancient name of a country of Natolia in Asia, now called *Carimania* and *Cay-bay*, between Lycia and Cilicia, on the south coast, to the north of the Mediterranean sea.

PAN, the god of shepherds, hunters, and all country exercises. Such he is described by the Greek and Roman poets; but he bore a higher character among the earliest Greeks, as well as among the Egyptians; from whom his worship was borrowed by that people. In Egypt he was known by the name of *Mendes*, which, according to Jablonski *, signifies fecundity. Hence his symbol was a living he-goat, the most salacious of all animals: "Hircum Mendesium coluntur Ægypti, eo quod virtuti prolificæ ac genitivæ, consecratus est.—Nam animal hoc coitus valde cupidum est." His principal temple was a magnificent building in a city of Lower Egypt, called after his name. It is well known (see POLYTHEISM) that from dedicating certain animals to certain gods, the Egyptians proceeded to consider the animals themselves as actuated by the divinities to whom they were sacred. Hence the origin of brute worship. In the temple of Mendes was kept a *he-goat*, to whom sacrifices of a very monstrous kind were offered. Herodotus, speaking of the præfecture of *Mendes*, says †, *Εγενετο δ' εν τω νομω τουτω επ εμεο τουτο το τερας γυναικι τραγος εμισγετο αναφανδον. Τουτο ες επιδεξιν ανθρωπων απικετο*. Our readers, learned and unlearned, will forgive us for not translating this passage, which contains, however, nothing that is not confirmed by the testimony of other writers; particularly of Plutarch, and Pindar as he is quoted by Strabo. The most wonderful circumstance of this monstrous sacrifice is, that it was made publicly in the presence of a great concourse of men! But to what divinity was it made? To a mere goat, or to some superior principle animating the goat? Doubtless to the latter; for it is said that the fair worshippers were of the first rank, and of unspotted fame; and that if they had borne a different character, the deity would not have accepted of their devotions.

* Panthe. Egypti. rum.

† Lib. ii. ch. 26.

The deity whom the Egyptians adored by the name of *Mendes*, was no other than the Soul of the Universe; for he was their most ancient god: and we are told by Plutarch ‡, "That they took the first God and the Universe for one and the same thing." Hence his name *Παν* among the Greeks: not that either the Greeks or their masters in theology worshipped, as their first god, mere brute matter, but that spirit which they conceived to be coeternal with matter, and to animate all things, making them *one*. Thus Orpheus, who imported the Egyptian doctrine into Greece, declares that all things are one: and after him Parmenidas, and other philosophers, taught *εν ειναι το παν*, that "one is the universe;" and that "the universe is immoveable." That the ancient Grecian *Pan*, or the Egyptian *Mendes*, was not the corporeal world, as senseless and inanimate, but the whole system of things animated and eternal, appears further from the following testimony of Macrobius. "Hunc deum Arcades colunt, appellantes *τον της υλης κυριον*, non sylvarum dominum, sed universæ substantiæ materialis dominatorem; —The Arcadians worship this god, calling him the lord

‡ De Isid. et Osir.

lord of HYLE; i. e. not the lord of the woods, but the lord of all material substance." In the same manner Pharnutus* describes the Pan of the other Greeks, not as the mere corporeal world, but as the intellectual principle actuating it and presiding over it: and he adds, that "Pan was feigned to be lascivious, because of the multitude of *spermatic reasons* in the world, and the continual mixtures and generation of things."

* Inter Thom. Gale, Scriptores Mythol. vet.

The Egyptians, as we learn from Jablonski, had nearly the same notion with the Greeks of the spirit which they worshipped as the Soul of the Universe; only they gave to it both sexes. As the maker, governor, and bountiful father of universal nature, they considered it as a *male*, whose symbol was the *he-goat* of Mendes; and as a *female* it was adored by the name of *Isis*, to whom the *she-goat* was consecrated, though not held in such veneration as the male. From this view of the Egyptian creed, the sacrifice which we have mentioned appears no longer unaccountable. It was made to a god, believed to be the universal source of fecundity, and to whom, from the well-known character of the animal whom he was supposed to actuate, they had reason to believe it would be most acceptable.

The Greeks never worshipped their Pan by the emblem of a living goat; but they painted him with the lower parts of a goat, for a reason which shall be afterwards mentioned. How he came to degenerate among that people, from one of the *Dii majorum gentium*, or rather from the first principle of all things, to the rank of a dæmon or demi-god, we cannot pretend to say: but that such was his fate, is certain; for under this last character mention is made both of his birth and his death.

Whose son he was, is not agreed among them. Homer makes him the son of Mercury, and says he was called *Pan* from *παν, omne*, because he charmed all the gods with his flute; others say that he was the son of Demogorgon, and first invented the organ, of seven unequal reeds, joined together in a particular manner: Having on a time fought with Cupid, that god in spite made him fall in love with the coy nymph Syrinx, who, flying from him to the banks of Ladon, a river of Arcadia, at the instant prayers of the Nymphs was turned into a reed, as her name in Greek signifies, which the god grasping instead of her, made a pipe of it, and for his music was adored by the Arcadians. The most common opinion was, that he was the son of Mercury and Penelope. But *Nat. Comes*, out of *Duris Samius*, makes his birth scandalous, by saying he was called *παν*, because begot by all Penelope's suitors. He was painted half-man half-goat, having large goats horns, a chaplet of pine on his red face, a pleasant laughter, with the feet and tail of a goat; a motley skin covering his body, with a crooked stick in one hand, and his pipe in the other. See him nicely described by *Sil. Ital.* 13. 326 *et seq.* a sight enough to fright women and children, yea, armed men too; for when Brennus the Gaul was about to pillage the temple of Apollo at Delphos, he by night struck such a terror into his army, that he quitted his sacrilegious design: hence *Panici terrores*. Yet, as homely as he was, he pleased the goddess Luna, turning himself easily into a white ram, Virgil, *Georg.* iii. 392. *et deinceps*; and the nymph Dryope also, almost putting off his divinity, and turning shepherd for her sake. Neither was he displeasing to other nymphs, who are generally made dancing round about him to hear the charms of his pipe. The usual offerings made him were milk and honey, in shepherds wooden bowls; also they sacrificed to him a dog, the wolf's enemy; whence his usual epithet is *λυκαιος*; and whence also his priests were called *Luperci*.

His festival was celebrated on February 15th by the Romans, brought into Italy by Evander the Arcadian, and revived afterwards by Romulus, in memory of his preserver. He was also called by the Romans *Inuus*, ab ineundo, *Vid.* Liv. i. 5. Macrob. Sat. i. 21. and Serv. in Virg. Æn. vi. 775. The ancients, by giving so many adjuncts and attributes to this idol, as we have observed above, seem to have designed him for the symbol of the universe; his upper parts being human, because the upper part of the world is fair, beautiful, smiling, like his face; his horns symbolize the rays of the sun and of the moon; his red face, the splendour of the sky; the spotted skin wherewith he is clothed, the stars which bespangle the firmament; the roughness of his lower parts, beasts and vegetables; his goat's feet, the solidity of the earth; his pipe, compact of seven reeds, the seven planets, which they say make the harmony of the spheres; his crook, bending round at the top, the years circling in one another. *Serv. Interpr.*

Having said so much of Pan, both as a self-existent god and as a generated dæmon, we shall conclude the article with some observations on Plutarch's account of the prodigy which happened at his death; for in the Pagan creed, dæmons were not all believed immortal.—"In the reign of Tiberius (says our author*), certain persons on a voyage from Asia to Italy, and sailing towards the evening by the Echinedes, were there becalmed, and heard a loud voice from the shore calling on one Thamus an Egyptian pilot whom they had on board. Thamus, as may be supposed, listened with attention; and the voice, after repeating his name thrice, commanded him when he came to the Pelodes, to declare that the *Great Pan* was dead. The man, with the advice of his companions, resolved, that if they should have a quick gale off the Pelodes, he would pass by in silence; but that if they should be becalmed, he would perform what the voice had commanded. Adhering to this resolution, they soon arrived off the destined islands, and were immediately becalmed, there being neither breath of wind nor agitation of water. Upon this Thamus looking from the hinder part of the ship towards the land, pronounced with a loud voice *ὁ μεγας Παν τεθνηκε*, *The Great Pan is dead!* and was instantly answered from the shore by numberless howlings and lamentations."

* Lib. de Oracul. Defect.

This story, which has so much the air of imposture, has not only been admitted as truth by men of the first eminence for learning and acuteness, but has been applied to our Saviour, whose death (says Cudworth) the dæmons mourned not from love, but from a presage that it would put a period to the tyranny and domination which they had so long exercised over the souls and bodies of men. In support of this opinion, he quotes several passages of Scripture, such as, "Now is the prince of this world judged;" and, "Having spoiled principalities and powers (by his death upon the cross), he triumphed over them in it." He affirms likewise, that "Pan being taken for that reason

son

son or understanding by which all things were made, and by which they are all governed, or for that divine wisdom which diffuseth itself through all things, is a name which might very well signify *God manifested in the flesh.*"

The authority of Cudworth is great; but a groundless opinion has seldom been propped by weaker reasoning than he makes use of on this occasion. Plutarch indeed says, and seems to believe, that this prodigy fell out during the reign of Tiberius; but as he mentions not the year of that reign, there is no evidence that it was at the crucifixion of our Saviour. The dæmons who inhabited the Echinedes knew what had been transacted at Jerusalem far distant from their islands; they knew the name of the pilot of a strange ship; they knew that the mariners of that ship had resolved to disobey their command, unless becalmed off the Pelodes; they had power over both the winds and waves at the *Pelodes*, and exerted that power to enforce obedience to their command; and yet these all-knowing and powerful beings were under the necessity of calling in the aid of a *man* to deliver a message to their companions, inhabiting a place to which the very same story assures us that their own power and knowledge reached. Should it be said that the dæmons were compelled by divine power thus publicly to make known to man Christ's triumph over the kingdom of darkness, we beg leave to ask why they were not likewise compelled to give him another name, since it is certain, that at the æra of Tiberius, and long before, illiterate Pagans, such as common seamen must be supposed to have been, knew no other *Pan* than the fabled son of Penelope and Mercury?—Indeed the other Pan, taken for that reason or understanding by which all things were made, could not possibly be the being here meant; for, erroneous as the Pagan system was, there is nothing in it so completly absurd as the death of the soul of the universe, the maker of all things: nor do we believe that any Pagan ever existed, who dreamed that such a death was possible.

What then, it will be asked, are we to understand by this story? Plutarch was eminent for knowledge and integrity, and he relates it without expressing a doubt of its truth. He does so; but many a man of worth has been credulous; and though that was not his character, this *prodigy* may be accounted for by natural means. Germanicus was believed to have been poisoned, at least with the knowledge, if not by the command, of Tiberius; and there was nothing which the Romans so deeply deplored as the untimely death of that accomplished prince*. They fancied that his body was animated, not by a human soul, but by a superior dæmon: and they decreed to him statues, religious ceremonies, and even sacrifices. His widow was highly honoured, as having been nearly related to a divinity, and his children were adored as demi-gods. These facts being admitted, nothing appears to us more probable than the opinion of the learned Mosheim†, who thinks that some shrewd statesman, in order to excite the popular fury against Tiberius to the highest pitch, invented this story, and bribed foreign mariners to spread it among the people, who would naturally believe, that by the great Pan was meant their favourite Germanicus. This hypothesis is at least countenanced by what Plutarch tells us of the anxiety of the emperor to discover what personage could be meant by the Pan whose death was announced to the seamen: he consulted the learned men of Rome, who, in order to restore peace to the city, declared that they understood it of none other than the son of Penelope and Mercury.

* *Tacit. Annal.* cap 72. 83. *et* lib. iii. cap. 1.

† *Cudworth's Intel. Syst.* cap. 4. note 132.

PANACEA, among physicians, denotes an universal medicine, or a remedy for all diseases; a thing impossible to be obtained.

PANADA, a diet consisting of bread boiled in water to the consistence of pulp, and sweetened with a little sugar.

PANAMA, the capital city of the province of Darien in South America, where the treasures of gold and silver, and the other rich merchandises of Peru, are lodged in magazines till they are sent to Europe. W. Long. 82. 15. N. Lat. 8. 57.

When Guzman first touched at this place in 1514, it consisted entirely of fishermen's huts. Orius d'Avila settled a colony here in a few years after, and in 1521 it was constituted a city by the emperor Charles V. with the proper privileges. In 1670 it was sacked and burnt by John Morgan, an English adventurer, who had the preceding year taken Porto Bello. This misfortune induced the inhabitants to remove the city to its present situation, distant about a league from the place where it stood before. For the greater security, the new city was inclosed by a free-stone wall, and the houses were built of stone and brick. Since that time several bastions have been added, and now there is always a complete garrison maintained, and the walls are mounted with large cannon. But all these precautions could not save this city from another misfortune; it was entirely consumed by fire in the year 1737. After this accident it was again rebuilt, in the manner as it now stands, with neat elegant houses, but not magnificent. The inhabitants are rather independent in their fortunes than rich; there are few of them opulent, and scarce any in a state of poverty. As to the harbour, it is convenient, and well secured against storms by a number of surrounding islands, and is capable of containing the largest fleets. Here the royal audience is seated, at which the governor of Panama resides; for which reason this city is commonly deemed the capital of the province.

This place, a little while after it was founded, became the capital of the kingdom of Terra Firma. Some hopes were at first entertained from the three provinces of Panama, Darien, and Veragua, which composed it; but this prosperity vanished instantaneously. The savages of Darien recovered their independence; and the mines of the two other provinces were found to be neither sufficiently abundant, nor of an alloy good enough to make it worth while to work them. Five or six small boroughs, in which are seen some Europeans quite naked, and a very small number of Indians who have come to reside there, form the whole of this state, which the Spaniards are not ashamed of honouring with the great name of kingdom. It is in general barren and unwholesome, and contributes nothing to trade but pearls.

The pearl fishery is carried on in the islands of the gulf. The greatest part of the inhabitants employ such of their negroes in it as are good swimmers. These slaves plunge and replunge into the sea in search of of pearls, till this exercise has exhausted their strength or their spirits.

Every negro is obliged to deliver a certain number of oysters. Those in which there are no pearls, or in which the pearl is not entirely formed, are not reckoned. What he is able to find beyond the stipulated obligation, is considered as his indisputable property: he may sell it to whom he pleases; but commonly he cedes it to his master at a moderate price.

Sea monsters, which abound more about the islands where pearls are found than on the neighbouring coasts, render this fishing dangerous. Some of these devour the divers in an instant. The manta fish, which derives its name from its figure, surrounds them, rolls them under its body, and suffocates them. In order to defend themselves against such enemies, every diver is armed with a poniard: the moment he perceives any of those voracious fish, he attacks them with precaution, wounds them, and drives them away. Notwithstanding this, there are always some fishermen destroyed and a great number crippled.

The pearls of Panama are commonly of a very fine water. Some of them are even remarkable for their size and figure: these were formerly sold in Europe. Since art has imitated them, and the passion for diamonds has entirely superseded or prodigiously diminished the use of them, they have found a new mart more advantageous than the first. They are carried to Peru, where they are in great estimation.

This branch of trade has, however, infinitely less contributed to give reputation to Panama, than the advantage which it hath long enjoyed of being the mart of all the productions of the country of the Incas that are destined for the old world. These riches, which are brought hither by a small fleet, were carried, some on mules, others by the river Chagre, to Porto Bello, that is situated on the northern coast of the isthmus which separates the two seas. See DARIEN.

PANARI, one of the Lipari islands, lying in the Tuscan sea. It is only five miles in circumference, and the soil is barren. E. Long. 15. 0. N. Lat. 39. 0.

PANARO, a river of Italy, which rises in the Apennines, crosses the valley of Frignano, and running on the confines of the Modenese and Bolognese, waters Fenal, and falls into the Po at Bondeno, ten miles above Ferrara.

PANATHENÆA, παναθηναια, in Grecian antiquity, an ancient Athenian festival, in honour of Minerva the protectress of Athens, and called *Athenæa*. Harpocration and Suidas refer the institution of this festival to Erichthonius IV. king of Athens, who lived before Theseus. Theodoret alone says the feast was established by Orpheus. Be this as it will, till Theseus it was never a particular feast of the city of Athens, and was called simply *Athenæa*: but that prince, uniting all the people of Attica into one republic, they afterwards all assisted at the feast; whence the name *Panathenæa*, i. e. the feast of all Attica. In effect all Attica was present; and each people sent a bullock for the sacrifices, and for the entertainment of the vast multitude of people assembled.

There were two festivals under this denomination, the greater and the lesser. The greater panathenæa were exhibited every five years; the less every three, or, according to some writers, annually. Though the celebration of neither, at first, employed more than one day; yet in after times they were protracted for the space of many days, and solemnized with greater preparations and magnificence than at their first institution.

The ceremonies were the same in the great and the little panathenæa; excepting for a banner, wherein the actions of the goddess were represented in embroidery, performed by maids, with the names of those who had distinguished themselves in the service of the republic; which was only borne at the greater.

Prizes were established there for three different kinds of combat: the first consisted of foot and horse races; the second, of athletic exercises; and the third, of poetical and musical contests. These last are said to have been instituted by Pericles. Singers of the first class, accompanied by performers on the flute and cithara, exercised their talents here upon subjects prescribed by the directors of these exhibitions.

The following is the order observed in this festival, according to M. Barthelemi, who quotes numerous authorities on the occasion: "The inhabitants of the different towns of Attica thronged to the capital, leading with them a great number of victims destined for sacrifices to the goddess. In the first morning were the horse-races, in which the sons of the first citizens of Athens contended for the honour of the victory. In the stadium were other young men struggling for the prize at wrestling, and different exercises of the body; and in the odéum were several musicians engaged in gentler and less perilous contests. Some executed pieces on the flute or cithara; others sang, and accompanied their voices with one of these instruments. The subject proposed to them was the eulogium of Harmodius, Aristogiton, and Thrasybulus, who had rescued the republic from the yoke of the tyrants by which it was oppressed: for, among the Athenians, public institutions are so many monuments for the citizens who have served the state, and lessons for those who are called upon to render it service. A crown of olive, and a vessel filled with oil, were the prizes bestowed upon the victors. Crowns were afterwards conferred on individuals, who appeared to the people to have merited that mark of honour by their zeal in the service of their country.

Anacharsis, vol. ii. p. 434.

"At the Ceramicus passed a procession, formed without the walls, and which began at that place to file off. It was composed of different classes of citizens crowned with chaplets of flowers, and remarkable for their personal beauty. Among the number were old men of a majestic and venerable appearance, bearing branches of olive; middle-aged men, who, armed with lances and with bucklers, seemed only to respire war; youth from 18 to 20, who sang hymns in honour of the goddess; beautiful boys, clad in a simple tunic, adorned only with their native graces; and, lastly, girls, who were of the first families in Athens, and whose features, shape, and deportment, attracted every eye. With their hands they held baskets on their heads, which, under a rich veil, contained sacred utensils, cakes, and every thing necessary for the sacrifices. Female attendants, who followed them, with one hand held over them an umbrella, and carried in the other a folding chair. This is a species of servitude imposed on the daughters of all foreigners settled at Athens: a servitude they share in common with their fathers and mothers, who likewise carried on their shoulders vessels filled with water and honey, for the purpose of libations. They were followed by eight musicians; four of whom played on the flute and four on the lyre. After them came rhapsodists singing the poems of Homer; and dancers armed at all points, who, attacking each other at intervals, represented, to the sound of the flute, the battle of Minerva with the Titans. Next came a ship that appeared to glide over the ground by the power of the wind, and the efforts of a great number of rowers, but which really was put in motion by concealed machinery. The vessel had a sail of light stuff, on which young girls had represented in embroidery the victory of Minerva over the Titans. On it also they had depicted by order of the government, some heroes whose illustrious deeds had merited to be celebrated with those of the gods. This procession marched on with solemn steps, under the direction of several magistrates; and traversed the most frequented quarter of the city amidst a crowd of spectators, most of whom were placed on scaffolds erected for the occasion. When it had reached the temple of the Pythian Apollo, the sail of the ship was taken down and carried to the citadel, where it was deposited in the temple of Minerva.

"In the evening, at the academy, was the torch race. The course is only six or seven stadia in length. It extends from the altar of Prometheus, which is at the gate of this garden, to the walls of the city. Several young men are stationed in this interval at equal distances. When the shouts of the multitude have given the signal, the first lights his flambeau at the altar, and, running with it, hands it to the second, who transmits it in the same manner to the third, and so successively. He who suffers it to be extinguished can no more enter the lists; and they who slacken their pace are exposed to the railleries, and even blows, of the populace. To gain the prize, it is necessary to have passed through the different stations with success. This trial of skill was frequently repeated, and is diversified according to the nature of the festivals.

"The candidates who had been crowned at the different exercises invited their friends to supper. Sumptuous repasts were given in the prytaneum and other public places, which lasted till the following day. The people among whom the immolated victims were distributed spread tables on every side, and gave a loose to their lively and tumultuous mirth."

PANAX, Ginseng; a genus of plants belonging to the polygamia class. See Botany and Materia Medica *Index*.

PANAY, an island of Asia, and one of the Philippines, lying between those of Paragoa and Negro. It is 250 miles in circumference, and is the most populous and fertile of them all. It is watered by a great number of rivers and brooks, and produces a great quantity of rice. Its shape is triangular. The names of its principal capes are Potol, Naso, and Bulacabi. The coast from Bulacabi to Potol lies east and west; from Potol to Naso, north and south; from Bulacabi to Iloilo, another cape, less than the great ones, is also north and south; from Iloilo to Cape Naso, east and west. The middle of the island is in the latitude of ten degrees. On the north side, almost in the middle between the two capes of Potol and Bulacabi, the famous river Panay falls into the sea; and the mouth of the harbour is covered by a small island called *Lutaya*, in which port the

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Spaniards had a safe retreat before they discovered and conquered Manilla and Cavité. The fertility of Panay is caused by the many rivers that water it, for there is no travelling a league without meeting a river; but more particularly by the Panay, which gives its name to the island, and runs a course of 40 leagues. The island, for the better administering of justice, is divided into jurisdictions: the first, called *Panay*, contains all that lies between Cape Potol and Bulacabi; the rest of the island is subject to the alcayde of Otton, who resides at Iloilo, a point of land running out into the sea, on the south side, between the two rivers of Tig Bavan and Jaro, and, with the island Imaras, forms a strait not above half a league over, or rather an open harbour. On this point the governor Don Gonzalo Ronquillo caused a fort to be built in the year 1681. The island contains about 16,360 tributary Indians, partly belonging to the king and partly to particular encomienderos or lords; but they all pay in rice, the island producing 100,000 bushels, Spanish measure, and but little other grain. The inhabitants are stout, lusty, and industrious farmers, and expert huntsmen, the country being full of wild boars and deer. The women make cloth of several colours. There are in the island 14 parishes, belonging to the fathers of the order of St Augustin, three benefices of secular priests, and formerly one college of the society of Jesus, where they administer the sacraments to the garrison of Iloilo. Besides the tributary Indians, there are here those blacks the Spaniards called *Negrillos*, who were the first inhabitants of the island, and afterwards driven into the thick woods by the Bisayas who conquered it. Their hair is not so stiff curled, nor are they so stout and strong as the Guinea blacks. They live in the most uncouth parts of the mountains with their wives and children, all naked like beasts. They are so swift that they often overtake wild boars and deer. They stay about the dead beast as long as it lasts; for they have no other subsistence but what they acquire with their bow and arrows. They fly from the Spaniards, not so much through hatred as from fear. Among the islands about Panay lies Imaras, opposite to Iloilo, and about a quarter of a league distant. It is long and low, ten leagues in compass and three in length, the soil fertile, abounding in sarsaparilla, and exceeding good water. On the mountains there are wild boars, deer, and good timber. It has also in it the port of St Anne, three leagues from Iloilo.

PANCARPUS, in Roman antiquity, a kind of show which the Roman emperors frequently exhibited to the people. The word is formed from the Greek παν, *all*, and καρπος, *fruit*. Whence the name was also given by the Athenians to a sacrifice wherein all kinds of fruits were offered. In this spectacle, the circus being all set over with large trees, represented a forest, into which the beasts being let from the dens under ground, the people, at a sign given by the emperor, pursued, shot, and killed all they could lay hold of, which they afterwards carried away, to regale upon at home. The beasts usually given on these occasions were boars, deer, oxen, and sheep.

Casaubon, Cujas, Pithou, &c. make the pancarpus and sylva the same thing; Salmasius will have them different. The sylva, according to him, was such a diversion as that above described: but the pancarpus a combat, wherein robust people, hired for that purpose, fought

fought with wild beasts: which opinion he confirms from Cassian, Justinian, Claudian, Firmicus, Manilius, and Cassiodorus.

PANCRAS, a town of England, in the county of Middlesex, on the north-west side of London, and in the highway to Kentish town. It church is one of the prebends of St Paul's, of which cathedral some call it the mother, it being thought to be as old as that church even in the reign of Queen Elizabeth, when it is represented as weather-beaten and standing alone, without any company, though it had formerly many buildings about it. A veterinary college was established here in 1791, for the improvement of farriery, and the treatment of cattle in general.

PANCRATIUM, (compounded of παν, *all*, and κρατεω, *I overcome*), among the ancients, a kind of intermixed exercise, consisting of the lucta or wrestling, and the boxing or pugilate: but it differs in this, that as the athletæ are not to seize the body, their hands are not armed with gauntlets, and give less dangerous blows.

The *pancratium* was the third gymnastic exercise, and was not introduced till long after the others. The people who were engaged in these exercises were called *pancratiastæ;* which name was also given to such as did not confine themselves to one exercise, but succeeded in several different ones.

Barthelemi, in his Travels of Anacharsis, gives us a short account of one of those at which he supposes him to have been present, in these words: "The action was soon terminated: a Sicyonian named *Sostrastus*, a champion celebrated for the number of prizes he had won, and the strength and skill which had procured them, had arrived the preceding day. The greater part of the combitants yielded up all pretensions to the crown as soon as he appeared, and the others on the first trial; for in those preliminary essays in which the athletæ try their strength by taking each others hands, he squeezed and twisted the fingers of his adversaries with so much violence as instantly to decide the victory in his favour."

Anacharsis, vol. iii.

PANCREAS. See ANATOMY *Index*.

PANDA, in *Mythology*, a goddess who was invoked and honoured as the protectress of travellers and navigators. The goddess of peace was also called *Pandar*, because she opened the gates of cities which were shut in time of war. According to Varro, Panda is a surname of Ceres, derived *à pane dando*, because she gave bread to mankind.

PANDATARIA (Suetonius, Pliny, Strabo); PANDATERIA (Mela, Tacitus): An island in the Tuscan sea: a place of banishment for the more illustrious exiles. Hither Julia, the daughter of Augustus, was banished for her incontinence. To this island Tiberius banished Agrippina his daughter-in law (Suetonius). It was the place of confinement of Octavia the daughter of Clodius, married to Nero; a sight that affected every eye (Tacitus). Now *Santa Maria*, situated between Pontia and Ischia (Holstenius).

PANDECTS, PANDECTÆ, in jurisprudence, the digest or collection, made by Justinian's order, of 534 decisions or judgments of the ancient lawyers, on so many questions occurring in the civil law; to which that emperor gave the force and authority of law, by the epistle prefixed to them.—The word is Greek, Πανδεκται, compound of παν, "all," and δεχομαι *capio*, "I take;" i. e. a compilation, or a book containing all things. Though others, as Bartoli, will have it formed from παν, and δεχομαι; as if these books contained the whole doctrine of the civil law.

The Pandects consist of 50 books, and make the first part of the body of the civil law.

They were denoted by two ππ; but the copyists taking those ππ for *ff*, the custom arose of quoting them by *ff*.

In the year 1137, the Pandects of Justinian, which had been brought by an Amalfitan merchant from the east, fell into the hands of the Pisans. Angelus Politianus believes this copy to be that which had been compiled by order of the emperor. However that be, it is certain that all other copies are taken from it, as being the most ancient. The Pisans having obtained their request from the emperor, carried the volumes to Pisa, and for near three centuries they were known by the name of the *Pandectæ Pisaræ*. But, about the year 1416, Pisa being taken by the Florentines, they were transported from thence to Florence, where they are now preserved in the library of the Medici, and known by the name of the *Pandectæ Florentinæ*. Some authors allege, that Lotharius ordained by an edict that the Pandects should be publicly read and explained at Bologna, and pleaded in the tribunals; but Corringius and Lindenbrogius fully refute their opinion.

Papias extends the denomination of *Pandects* to the Old and New Testament.

There are also PANDECTÆ *Medicinæ*, "Pandects of Medicine;" a kind of dictionary of things relating to medicine, compiled by Mat. Sylvaticus of Mantua, who lived about the year 1297. Leunclavius has published *Pandects of Turkey;* and Bishop Beveridge *Pandecta Canonum*.

PANDICULATION, a stretching; or that violent and extensive motion of the solids that usually accompanies the act of yawning.

PANDORA, in fabulous history, a woman formed by Prometheus, to whom each of the gods gave some perfection. Venus bestowed upon her beauty; Pallas, wisdom; Juno, riches; Apollo, music; and Mercury, eloquence: but Jupiter being displeased at Prometheus for having stolen fire from heaven to animate the mass he had formed, gave Pandora a box, which she was ordered not to open; and then sent her to the earth with this box, in which were enclosed age, diseases, pestilence, war, famine, envy, discord, and all the evils and vices that could afflict mankind. This fatal box was opened by Epimetheus, Prometheus's brother, when instantly all the diseases and mischiefs with which it was filled spread over the earth, and Hope only remained at the bottom. Hesiod says she was the first woman.

PANDOURS, are Hungarian infantry: they wear a loose garment fixed tight to their bodies by a girdle, with great sleeves, and large breeches hanging down to their ankles. They use fire-arms and are excellent marksmen: they have also a kind of sabre near four feet long, which they use with great dexterity.

PANDOSIA (Livy, Justin, Strabo), an inland town of the Bruttii, and a place of strength on the river Acheron, where Alexander of Epirus, deceived by the oracle of Dodona, met his fate and perished. Now *Mendicino* (Holstenius.) Another of Epirus (Strabo); situated

situated on the river Acheron (Livy); which Alexander of Epirus was advised to avoid as fatal, but which he met with in Italy. This last is said to have been the residence of the Oenotrian kings (Strabo).

PANDURA, or PANDORON, a musical instrument, used among the ancients, resembling the lute. The word is said to be formed from the Greek παν and δωρον, i. e. "all gifts, all sorts of gifts." Isidore derives the name from its inventor *Pandorus;* others from *Pan*, to whom they attribute its invention, as well as that of the flute. It has the same number of strings with the lute; but they are of brass, and of consequence give a more agreeable sound than those of the lute. Its frets are of copper, like those of the cistre; its back is flat, like that of the guitar; and the rims of its table, as well as its ribs, are cut in semicircles. Du Cange observes, that Varro, Isidore, and others of the ancients, mention it as having only three strings; whence it is sometimes also spoken of under the denomination τριχορδον, *trichordum*.

PANEAS (Pliny, Josephus): the apparent spring from which the Jordan rises, on the extremity of the west side of the Trachonitis (Pliny).

PANEAS (Coins, Pliny, Josephus), the name of a district adjoining to the spring *Paneas*, with a cognominal town, either enlarged and adorned, or originally built, by Philip son of Herod, and called *Cæsarea* by Josephus, and in St Matthew, *Cæsarea of Philip;* with a temple erected to Augustus his benefactor, who conferred the Trachonitis upon him (Coin). It was afterwards called *Neronias*, in honour of Nero (Josephus).

PANEGYRIC, an oration in praise of some extraordinary thing, person, or virtue.

The name is Greek, πανηγυρις; formed of παν, "all," and αγυρω, "I assemble;" because anciently held in public and solemn assemblies of the Greeks, either at their games, their feasts, fairs, or religious meetings.

To make their panegyrics the more solemn, the Greeks used to begin with the praises of the deity in whose honour the games, &c. were celebrated; then they descended to the praise of the people or country where they were celebrated; then to the princes or magistrates who presided at them; and at length to the champions, especially the conquerors, who had gained the prizes in them.

PANEGYRICUM, in church history, an ecclesiastical book, used by the Greek church, containing the panegyrical orations of various authors, on the solemnities of Jesus Christ and the saints. It is found in MS. in most churches, but it is not the same in all; each church having its particular saints; and the compilers of this kind of books usually suited their collections to the taste of their own devotion. They are disposed according to the order of the months, and frequently consist of 12 volumes, answering to the 12 months of the year.

Among the principal authors of this work are Athanasius, Cyril, Basil, Chrysostom, &c.

PANEL, (*Panella, Panellum*), according to Sir Edward Coke, denotes "a little part;" but the learned Spelman says, that it signifies *schedula vel pagina*, "a schedule or roll;" as a panel of parchment, or a counterpane of an indenture: but it is used more particularly for a schedule or roll, containing the names of such jurors as the sheriff returns to pass upon any trial. And the *impanelling* a jury is the entering their names in a panel or little schedule of parchment.

PANEL, in *Scots Law*, signifies the prisoner at the bar, or person who takes his trial before the court of justiciary for some crime.

PANGOLIN, a species of the manis peculiar to Hindostan. See MANIS, MAMMALIA *Index*.

PANIC, denotes an ill-grounded terror or fright. Polyænus says, it originates from *Pan*, one of the captains of Bacchus, who with a few men put a numerous enemy to rout, by a noise which his soldiers raised in a rocky valley, favoured with a great number of echoes. This stratagem making their number appear far greater than it was, the enemy quitted a very commodious encampment, and fled. Hence all ill-grounded fears have been called *panics*, or *panic fears;* and it was this that gave occasion to the fable of the nymph Echo's being beloved by the god Pan. Others derive the origin of it hence: that in the wars of the Titans against the gods, Pan was the first who struck terror into the hearts of the giants. Theon on Aratus says, he did it by the means of a sea shell, which served him for a trumpet, whereof he was the inventor.

PANICLE, in *Botany*, denotes a soft woolly beard, on which the seeds of some plants hang pendulous; as in millet, reeds, and hay.

PANICUM, a genus of plants belonging to the triandria class. See BOTANY *Index*.

PANINI, PAOLO, a painter of perspective and architecture. He was born at Placentia in 1691, with a most happy genius to painting, which he cultivated by studying at Rome, where he designed every vestige of ancient magnificence, the ruins of superb Roman edifices, cenotaphs, columns, baths, arches, and obelisks, as also some of the most entire buildings, the ornaments of modern Rome.

He studied the works of Ghisolfi with peculiar pleasure; he formed his taste, style, and manner, by the compositions of that esteemed artist; and his strongest ambition was to imitate him; so that he soon became eminent in that style beyond all his contemporaries. His composition is rich; the truth of his perspective is critically exact; and his paintings are universally esteemed for the grandeur of the architecture, for the clearness of his colouring, for the beautiful figures which he generally introduced, and also for the elegant taste with which he disposed them. He always designed them correctly, and set them off with suitable attitudes and expression.

However, this description of his merit must be supposed to allude to his early and prime performances; for in his latter time, his pictures were distinguishable by a free and broad touch, but they are feeble in their colouring and effect. At all times, indeed, he was too apt to design his figures rather too large for the architecture, which diminished the grandeur of the most magnificent parts of his composition, and was quite contrary to the practice of Ghisolfi; whose works must perpetually afford a pleasing deception to the eye, by the perspective proportions observed between the figures, buildings, and distances.

At Rivoli, a pleasure house belonging to the king of Sardinia, there are several of Panini's paintings, which are views of that fine retreat and its environs. They are beautifully coloured, well handled, and with a touch

full

full of spirit; though in some parts the yellow seems a little too predominant, and the lights are not always distributed in such a manner as to produce the most striking effect.

PANIONIA, in antiquity, a festival celebrated in honour of Neptune by a concourse of people from all the cities of Ionia. It is remarkable in this festival, that if the bull offered in sacrifice happened to bellow, it was accounted an omen of divine favour; because that sound was thought to be acceptable to Neptune.

PANNARIA, one of the Lipari islands. See LIPARA and LIPARI.—The ancients called it *Thernisia*, from the hot waters which they found in it. It may be about eight or nine miles in circumference. It bears wheat, and grapes, from which the inhabitants make wine. Pannaria, like the other adjacent islands, appears to be a volcano; its original having been destroyed by continued eruptions. It is now no longer of a conical figure. It contains about 100 inhabitants, reckoning every soul, men, women, and children. It is, like Stromboli, governed by a curate, who depends on the priest of the parish of St Joseph in Lipari; and when any couple in the island determine to marry, they must cross the sea to Lipari to receive the nuptial benediction in the parish of St Joseph, or pay a sum for a license to empower the curate of Pannaria to perform the ceremony. All the other adjoining islands are subject to the same regulation.

The inhabitants of Pannaria live by fishing, and by taking small quantities of game on this and the little contiguous islands. They bring up and tame those birds known by the name of *gulls*, which are seen in tempestuous weather flying near the surface of the sea. They are here called *corracio*. The body of the bird and the tips of its wings are white; but the head, the tail, and the rest of the wings, are gray: they are of the size of Indian hens; their wings are prodigiously large: they have their nests on the steep inaccessible cliffs of the several islands. When the islanders bring these birds up tame, they feed them with fish, which, though of such size that you would think it impossible for their stomachs to receive them, they eagerly stretch their necks and swallow rapaciously. These birds are thus brought up to be as tame as pullets or pigeons; and such an attachment do they often acquire to the places in which they are reared, that some of them have been known to return to these islands after being conveyed to Mellazzo and Messina.

On the summit of a hill in this island, which projects over the sea, the inhabitants pretend to show a castle and an inscription. But their castle is only an elevated peak of the rock, which nature seems to have prepared as a retreat for birds. It consists of puzzolana; and has been actually formed by the action of winds and rains, for a long course of time, into a fantastic figure, which may appear, when carelessly viewed from a distance by an undistinguishing eye, the remains of some ancient structure. The good people of the island, not being able to judge of it otherwise than from appearance, are persuaded, that it can be nothing but a castle, which must have been reared for the defence of the island against the Turks and the corsairs of Barbary. These they consider as the most dreadful scourge with which mankind can possibly be afflicted, and fear them much more than the eruptions of the volcano. When they feel their island shaken, they embark with all their wealth, which a single sloop easily contains; and on board they are safe from both the shaking of the earth and the eruptions of the lava, but not from an hostile fleet.

In this island there appear various remains of ancient buildings, but very ruinous and very scanty. In ploughing the fields, many remains of sepulchres, in different modes of construction, are found; some of rough stones, tiles, or bricks; others consisting each of a single stone. Vases of various sorts and sizes are also said to have been found in the same fields, utensils of different kinds, money, chains, and medals of lead. But none of these relicks of antiquity have been preserved: the good people who found them were ignorant of their value, and therefore neglected them as trifles. In places along the shore of the island, where the sea appears to have encroached, there are some hewn stones to be seen: they seem to be remains of walls, which must have been very strong and of elegant architecture. In other places farther distant from the shore, there likewise appear fragments of walls sunk in the ground, and apparently overwhelmed with mud, which the winds and rains have brought down from the mountain above. These remains show, that Pannaria, either under the Greeks, or in that period when all the elements were taxed for the gratification of Roman luxury, must have been adorned with superb buildings, as well as the adjacent islands of Lipari, Stromboli, and Basiluzzo.

PANNELS *of a* SADDLE, are two cushions or bolsters, filled with cows, deer, or horses hair, and placed under the saddle, on each side, to prevent the bows and bands from galling the horse.

PANNICULUS CARNOSUS, in *Comparative Anatomy*, a robust fleshy tunic, situated in beasts between the skin and the fat; by means of which they can move their skin in whole or in part. It is altogether wanting in mankind.

PANNONIA (Pliny, Strabo, Dio), an extensive country of Europe, having the Danube on the north, Dalmatia on the south, Noricum on the west, and Moesia on the east. It is divided into *Superior* and *Inferior* (Ptolemy, Dio). The common boundary between both were the river Arabo and Mount Cetius, having the Superior to the west, and the Inferior on the east side. This division is thought to be no older than the times of the Antonines. *Pannonicus* the epithet (Martial).

PANOMPHÆUS, in antiquity, a designation given to Jupiter, because he was said to be the original author of all sorts of divination, having the books of fate, and out of them revealing either more or less, as he pleased, to inferior demons.

PANOPOLIS. See ACHMIM.

PANORMUS (Polybius, Pausanias), a town of Achaia, in Peloponnesus, near the promontory Rhium.—Another (Ptolemy, Pliny), a town on the north side of Crete.—A third (Ptolemy), in Macedonia, on the Ægean sea, near Mount Athos.—A fourth, of Samos (Livy).—A fifth, of Sicily; an ancient city, built by the Phœnicians (Thucydides); a principal town of the Carthaginians (Polybius); situated between Lilybæus and Pelorus (Mela); a Roman colony. Now *Palermo*, capital of the island, on the north side. E. Long. 13. N.

N. Lat. 38. 30.—A sixth Panormus of the Thracian Chersonesus, placed by Pliny on the west side of the peninsula, and mentioned by no other writer.

PANORMUS (Ptolemy), a port of Attica; its name denoting it to be capacious.—Another, of Epirus (Strabo, Ptolemy); a large harbour in the heart of the Montes Ceranni, below the citadel Chimæra.—A third of Ionia (Strabo); near Ephesus, with the temple of the Ephesian Diana.

PANORPA, the SCORPION FLY, a genus of insects belonging to the order of neuroptera. See ENTOMOLOGY *Index*.

PANTALARIA, an island in the Mediterranean sea, between Sicily and the main land of Africa, about 17 miles in circumference. It is near the coast of Tunis, and abounds in cotton, fruits, and wine; but the inhabitants are obliged to bring all their corn to Sicily, as it belongs to the king of the two Sicilies. E. Long. 12. 25. N. Lat. 36. 55.

PANTÆNUS, a Stoic philosopher, born in Sicily (though some have erroneously supposed him to be a Hebrew) about the beginning of the reign of Commodus. He presided over the celebrated school of Alexandria, where from the time of St Mark, the founder of that church, they had always a divine that was eminent for his learning and piety, to explain the Holy Scriptures, and to instruct them in human learning. This employment he was obliged to leave; for when the Indians required of Demetrius bishop of Alexandria to send them one to instruct them in Christianity, he sent Pantænus, who undertook the mission with joy, and behaved himself very properly in it. We are told, that the Indians had been tinctured with Christianity by St Bartholomew the apostle; and that Pantænus met with the Hebrew original of St Matthew's gospel, which the apostle had left there. St Jerome says that Pantænus brought it with him; and that it was, in his time, preserved in the library of Alexandria. But we suspect St Jerome to be mistaken in this respect. When Pantænus returned to Alexandria, he reassumed the government of the school of that city, which it is probable, he had, during his absence, committed to the care of St Clement, a presbyter of Alexandria. He explained the Scriptures publicly, under the reign of Severus Antoninus Caracalla; and was, in St Jerome's opinion, more serviceable to the church by his discourses than by his writings. He published some commentaries upon the Bible, which are lost. "That the prophets often express themselves in indifferent terms, and that they make use of the present time instead of the past and future," is a rule of Pantænus, which has been followed by all succeeding interpreters. Theodorus has related this rule; but he speaks of it as if Pantænus had rather said than written it.

We may have some notion of Pantænus's manner of explaining the Scriptures by the like performances of St Clement of Alexandria, Origen, and others who were brought up in that school.

PANTALOON, a sort of garment consisting of breeches and stockings of one piece; said to have been first introduced by the Venetians.

PANTALOON, on the theatre, is a buffoon or masked person, who performs high and grotesque dances, and shows violent and extravagant postures and airs. The word is likewise used for the habit or dress these buffoons usually wear; which is made precisely to the form of their body, and all of a piece from head to foot.

And hence those who wear a habit of this kind, for conveniency, under their other clothes, are called *pantaloons* of Venice.

PANTHEA, in antiquity, were single statues, composed of the figures, or symbols, of several different divinities together. Father Joubert, who calls them *panthea*, and who has remarked them sometimes on medals, says their heads are most commonly adorned with the symbols or attributes belonging to several gods. An instance of this appears in a medal of Antoninus Pius; which represents Serapis by the bushel it bears; the Sun by the crown of rays; Jupiter Ammon by the ram's horns; Pluto by the large beard; and Æsculapius by the serpent twisted in his hand. M. Baudelot, in a dissertation on the Lares, observes, that the *panthea* had their origin from the superstition of those, who, taking several gods for the protectors of their houses, united them all in the same statue, by adorning it with the several symbols proper to each of those deities.

PANTHEISM, a philosophical species of idolatry leading to atheism, in which the universe was considered as the supreme God. Who was the inventor of this absurd system, is, perhaps, not known; but it was of early origin, and differently modified by different philosophers. Some held the universe to be one immense animal, of which the incorporeal soul was properly their God, and the heavens and earth the body of that God; whilst others held but one substance, partly active and partly passive; and therefore looked upon the visible universe as the only *Numen*. The earliest Grecian Pantheist of whom we read was Orpheus, who called the world *the body of God*, and its several parts *his members*, making the whole universe one *divine animal*. According to Cudworth, Orpheus and his followers believed in the immaterial soul of the world; therein agreeing with Aristotle, who certainly held that God and matter are coeternal; and that there is some such union between them as subsists between the souls and bodies of men. See METAPHYSICS, N° 264.

In the ancient Orphic theology, we are taught, that "this universe, and all things belonging to it, were made *within* God; that all things are contained together in the womb of God; that God is the *head* and *middle* of all things; that he is the *basis* of the *earth* and *heaven*; that he is the *depth of the sea*, the *air* we breathe, the force of the untameable *fire*; that he is the *sun*, *moon*, and *stars*; that there is one divine *body*; for,

Παντα γαρ εν μεγαλω τα δε σωματι κειται,

"all these things lie in the great body of God."—But further, to prove that the most ancient Greek philosophers resolved all things into God, and made God *all*, we shall cite a most remarkable passage from Plutarch's Defect of Oracles. "Whereas there are two causes of all generations, the divine and the human, the most ancient theologers and poets attended only to the more excellent of these two; resolving all things into God, and pronouncing this of them universally;

Ζευς αρχη, Ζευς μεσσα, Διος δ' εκ παντα τετυκται,

'that God is both the beginning and middle, and that all things are out of God;' insomuch, that they had no

regard

regard at all to the other natural and necessary causes of things: but on the contrary, their juniors, who were called *naturalists*, deviating from this most excellent and divine principle, placed all in *bodies*, their passions, collisions, mutations, and commixtures."

That by the most ancient theologers here mentioned, Plutarch meant Orpheus and his immediate followers, is plain from the Orphic verse by which he proves their antiquity. By their juniors, whom he calls *naturalists*, he could mean no other than the first Grecian philosophers, *Anaximander*, *Anaximenes*, and *Hippo*, who were followed by the atheistical atomists, *Leucippus*, *Democritus*, *Protagoras*, and *Epicurus*. But with respect to the universe being God, and all things divine and human being modifications of mere matter, the stoics undoubtedly agreed with Anaximander and his followers; for the school of Zeno held but one substance. See METAPHYSICS, N° 265. This impious doctrine, that all things are God, and that there is but one substance, was revived in modern times by Spinoza, an apostate Jew. As we shall give a life of him and a view of his principles, we must refer the reader for a fuller account of Pantheism to SPINOZA. See also PAN.

PANTHEON, a beautiful edifice at Rome, anciently a temple, dedicated to all the gods; but now converted into a church, and dedicated to the Virgin and all the martyrs.

This edifice is generally thought to have been built by Agrippa son in-law to Augustus, because it has the following inscription on the frieze of the portico.

M. AGRIPPA L. F. COS. TERTIUM FECIT.

Several antiquarians and artists, however, have supposed that the pantheon existed in the times of the commonwealth; and that it was only embellished by Agrippa, who added the portico. Be this as it will, however, the pantheon, when perfected by Agrippa, was an exceedingly magnificent building; the form of whose body is round or cylindrical, and its roof or dome is spherical: it is 144 feet diameter within; and the height of it, from the pavement to the grand aperture on its top, through which it receives the light, is just as much. It is of the Corinthian order. The inner circumference is divided into seven grand niches, wrought in the thickness of the wall; six of which are flat at the top; but the seventh, opposite to the entrance, is arched. Before each niche are two columns of antique yellow marble fluted, and of one entire block, making in all 14, the finest in Rome. The whole wall of the temple, as high as the grand cornice inclusive, is cased with divers sorts of precious marble in compartments. The frieze is entirely of porphyry. Above the grand cornice arises an attic, in which were wrought, at equal distances, 14 oblong square niches: between each niche were four marble pilasters, and between the pilasters marble tables of various kinds. This attic had a complete entablature; but the cornice projected less than that of the grand order below. Immediately from the cornice springs the spherical roof, divided by bands which cross each other like the meridians and parallels of an artificial terrestrial globe. The spaces between the bands decrease in size as they approach the top of the roof; to which, however, they do not reach, there being a considerable plain space between them and the great opening. That so bold a roof might be as light as possible, the architect formed the substance of the spaces between the bands of nothing but lime and pumice-stones. The walls below were decorated with lead and brass, and works of carved silver over them; and the roof was covered on the outside with plates of gilded bronze. There was an ascent from the springing of the roof to the very summit by a flight of seven stairs. And if certain authors may be credited, these stairs were ornamented with pedestrian statues ranged as an amphitheatre. This notion was founded on a passage of Pliny, who says, "That Diogenes the sculptor decorated the pantheon of Agrippa with elegant statues, yet that it was difficult to judge of their merit, upon account of their elevated situation." The portico is composed of 16 columns of granite, four feet in diameter, eight of which stand in front, with an equal intercolumniation all along, contrary to the rule of Vitruvius, who is for having the space answering to the door of a temple, wider than the rest. On these columns is a pediment, whose tympanum, or flat, was ornamented with bas-reliefs in brass; the cross beams which formed the ceiling of the portico were covered with the same metal, and so were the doors. The ascent up to the portico was by eight or nine steps.

Such was the pantheon, the richness of which induced Pliny to rank it among the wonders of the world.

The eruption of Vesuvius, in the reign of Tiberius, damaged the Pantheon very considerably: it was repaired by Domitian; which occasioned some writers to mention that prince as the founder of the building. The emperor Adrian also did something to it. But it appears that the pantheon is more indebted to Septimius Severus, than to any one since its erection. The most, perhaps, that any of his predecessors had done, was the adding some ornament to it: Septimius bestowed essential reparations upon it. The following inscription appears upon the architrave:

IMP. CAES. SEPTIMIVS. SEVERVS.
PIVS. PERTINAX.
ARABICVS. PARTHICVS. PONTIF.
MAX. TRIB. POT.
XI. COS. III. P. P. ET. IMP. CAES.
MARCVS.
AVRELIVS. ANTONINVS. PIVS.
FELIX. AVG. TRIB.
POT. V. COS. PROCOS. PANTHEVM.
VETVSTATE.
OBRVPTVM. CVM. OMNI. CVLTV.
RESTITVERVNT.

It is really a matter of astonishment, that a structure, which, granting it to have been built by Agrippa, was not more than 200 years old, should have fallen into decay through age. This single consideration seems sufficient to confirm the opinion of those who believe it to have stood in the times of the commonwealth.

The temple subsisted in all its grandeur till the incursion of Alaric in the time of Honorius. Zozymus relates, that the Romans having engaged to furnish this barbarian prince with 3000 pounds weight of gold and 5000 pounds weight of silver, upon condition that he should depart from their walls; and it proving impossible to raise those sums either out of the public treasury or private purses, they were obliged to strip the temples

Pantheon. ples of their statues and ornaments of gold and silver. It is probable that the Pantheon supplied a good part, as that of Jupiter Capitolinus was the only one in Rome that could vie with it for riches.

Alaric carried off nothing from the Romans besides their precious metals. Thirty-nine years after this, Genseric king of the Vandals took away part of their marbles; and whether from a greediness of plunder, or from a relish of the productions of art, loaded one of his ships with statues. It cannot be questioned, but that on this occasion the Pantheon was forced to part with more of its ornaments, and that the inestimable works of Diogenes became the prey of this barbarian.

Before these unwelcome visits of the Goths and Vandals, the Christian emperors had issued edicts for demolishing the Pagan temples. But the Romans, whatever were their motives, spared the Pantheon, which is known to have suffered no damage from the zeal of the pontiffs, or the indignation of the saints, before the first siege of Rome by Alaric. It remained so rich till about the year 655, as to excite the avarice of Constantine II. who came from Constantinople to pillage the Pantheon, and executed his purpose so far as to strip it both of its inside and outside brazen coverings, which he transported to Syracuse, where they soon after fell into the hands of the Saracens.

About fifty years before this, Pope Boniface IV. had obtained the Pantheon of the emperor Phocas, to make a church of it. The artists of these days were totally ignorant of the excellence of the Greek and Roman architecture, and spoiled every thing they laid their hands upon. To this period certain alterations are to be referred, of which we shall speak by and by.

After the devastations of the barbarians, Rome was contracted within a narrow compass: the seven hills were abandoned; and the Campus Martius, being an even plain, and near the Tyber, became the ground-plat of the whole city. The Pantheon happening to stand at the entrance of the Campus Martius, was presently surrounded with houses, which spoiled the fine prospect of it; and it was yet more deplorably disgraced by some of them which stood close to its walls. Pedlars sheds were built even within its portico, and the intercolumniations were bricked up, to the irreparable damage of the matchless pillars, of which some lost part of their capitals, some of their bases, and others were chisseled out six or seven inches deep, and as many feet high, to let in posts. Which excavations are to this day half filled up with brick and mortar; a sad monument of the licentiousness of the vulgar, and of the stupid avarice of those who sold them the privilege to ruin the noblest piece of art in the world!

This disorder continued till the pontificate of Eugene IV. whose zeal for the decency of a consecrated place, prevailed upon him to have all the houses cleared away that encumbered the Pantheon, and so the miserable barracks in the portico were knocked down.

From the time Constantius carried off the brass plating of the external roof, that part was exposed to the injuries of the weather, or at best was but slightly tiled in, till Benedict II. covered it with lead, which Nicholas V. renewed in a better style.

It does not appear that from this time to Urban VIII. any pope did any thing remarkable to the Pantheon.

Raphael Urban, who had no equal as a painter, and who as an architect had no superior, left a considerable sum by his will for the reparation of the Pantheon, where his tomb is placed. Perino de la Vagua, Jacomo Udino, Hannibal Carracci, Flamingo Vacca, and the celebrated Archangelo Corelli, did the same. All the ornaments within, that have any claim to be called good, are of the later times; the paintings merit esteem; and the statues, though not masterpieces, do honour to sculpture, which alone is a proof that they are posterior to the 15th century.

But, with all the respect due to a pontiff, who was otherwise a protector, and even a practiser of the arts, it were much to be wished that Urban VIII. had not known that the Pantheon existed. The inscriptions cut at the side of the door inform us, that he repaired it; yet, at the same time that he built up with one hand, he pulled down with the other. He caused two belfries of a wretched taste to be erected on the ancient front work, and he divested the portico of all the remains of its ancient grandeur, viz. the brazen coverture of the cross beams, which amounted to such a prodigious quantity, that not only the vast baldaquin or canopy of the confessional in St Peter's was cast out of it, but likewise a great number of cannon for the castle of St Angelo. This pope, who was of the family of Barberini, presented also as much of this metal to his nephew, as was sufficient for the decoration of his new palace; on which occasion this remarkable pasquinade was stuck up:

Quod non fecerunt Barbari fecere Barberini.

If ever gingle added force to wit, it was certainly in this instance.

It is surprising, that whilst these operations were carrying on in the portico, he never once thought of repairing the damages which time had wrought in it! Of the 16 pillars which supported this magnificent pile, there were no more than 13 left; the three next the temple of Minerva had disappeared; with these the entablature and an angle of the front had tumbled down. There were not wanting in Rome fragments enough of antique columns that might have been put together, and set up, to have prevented the downfal of a pile which deserved to stand as long as the world endured.

Alexander VII. did what Urban VIII. had neglected to do. At the same time that Bernini was constructing the colonnade of St Peter, this pontiff ordered search to be made for pillars to match those of the portico of the Pantheon; and some were found not far from the French church of St Lewis of the very same model. They were granite of the isle of Ilva, or Elba, and those of the portico were Egyptian granite; the colour, however, was the same, so that the effect was equal. The pope's zeal did not stop here; he caused all the old houses before the portico to be pulled down, and the soil and rubbish to be cleared away which covered the steps, and even the bases of some of the pillars. He began covering the roof with marble, and raised a lantern over the aperture, to keep out rain; but death took him off before his project was completed. Clement

ment IX. his successor, inclosed the portico within iron rails. Several later popes have added to its decorations, which were all in the taste of the times they were done in; and the body of the edifice and its architecture gained nothing from them. The main object of their holinesses liberality was the embellishment of the grand altar. One gave purple curtains, another bestowed silver tabernacles; others again vases, and superb dresses, suited to the solemn ceremonies of religion. All these might be called rich; but they had in no sense a tendency to retrieve the ancient majesty or original splendour of the temple. The true gusto of the ornaments was a little imitated at the revival of the arts. Good statues took place of the skeletons and squat figures that ridiculously disgraced the altars for the space of eight centuries. The paintings of Perugino, Cozza, and Gressi, covered the dull mosaics with which the Greeks of Constantinople had loaded the walls of most of the churches in Rome. The porphyry and the green and yellow antique found among the old ruins were employed to much advantage.

There was besides at Rome another pantheon, dedicated to Minerva as the goddess of medicine. It was in the form of a decagon, and the distance from one angle to another measured about 22 feet and a half. Between the angles there were nine round chapels, each of which was designed for a deity; and over the gate there was a statue of Minerva. The pantheon of Athens was in many respects little inferior to the Roman one built by Agrippa. The Greek Christians also converted it into a church, dedicated it to the Virgin, under the name of *Panegia;* and the Turks changed it into a mosque. The pantheon of Nismes was a temple in that city, wherein were 12 niches for statues, supposed to have been destined for the 12 great gods. In the Escurial is a most magnificent chapel, called *panthcon*, 35 feet in diameter, and 38 feet high from the pavement, which is composed of marble and jasper inlayed. The whole inside of the chapel is of black marble, except the luthern, and some ornaments of jasper and red marble. In this chapel are deposited the bodies of the kings and queens; there are only places for 26, and eight of them are already filled.

PANTHER. See Felis, Mammalia *Index*.

PANTING, consists in a rapid succession of inspirations and expirations, which happens when we run or perform any violent motion.

PANTOMIME, Παντομιμος, among the ancients, a person who could imitate all kind of actions and characters by signs and gestures without speaking.

The pantomimes made a part in the theatrical entertainments of the ancients; their chief employment was to express, in gestures and action, whatever the chorus sung, changing their countenance and behaviour as the subject of the song varied. They were very ancient in Greece, being derived from the heroic times, according to some; but however this may be, they were certainly known in Plato's time. In Rome, it was so late as the time of Augustus before they made their appearance. As to their dress, it was various, being always suited as near as possible to that of the person they were to imitate. The crocota was much used among the Roman pantomimes, in which and other female dresses they personated women.

We have this account of them in Gibbon's history; "The pantomimes (A), who maintained their reputation from the age of Augustus to the sixth century, expressed, without the use of words, the various fables of the gods and heroes of antiquity; and the perfection of their art, which sometimes disarmed the gravity of the philosopher, always excited the applause and wonder of the people. The vast and magnificent theatres of Rome were filled by 3000 female dancers, and by 3000 singers, with the masters of the respective chorusses. Such was the popular favour which they enjoyed, that in a time of scarcity, when all strangers were banished from the city, the merit of contributing to the public pleasures exempted them from a law which was strictly executed against the professors of the liberal arts (B.)"

Pantomimes are still very common in England: they differ indeed in some respects from those of antiquity; but they retain the name, and like these they consist in the representation of things merely by gestures.

PANUCO, a town and province of North America, in New Spain, lying to the north of Mexico, with a bishop's see. There are veins of gold, and salt works, which are the principal revenue of the inhabitants.—It is seated near the mouth of a river of the same name, at a small distance from the gulf of Mexico. W. Long. 100. 5. N. Lat. 24. 0.

PAO-TING-FOU, in China, where the viceroy resides, is the most considerable city in the province next to Pekin. It has 20 others under its jurisdiction, three of the second and 17 of the third class. The country around it is pleasant, and inferior in fertility to no part of China. It is necessary to pass this city in going from Pekin to the province of Chan-si.

PAOLO, Marco. See Paulo.

PAPA, a small but strong town of Lower Hungary, in the county of Vesprin. It was taken from the Turks in 1683, after raising the siege of Vienna, and is subject to the house of Austria. It is seated on a mountain, near the river Marehaez, in E. Long. 18. 10. N. Lat. 47. 20.

PAP-CASTLE, in England, in Bridekirk parish, Cumberland, stood two miles from Cockermouth, on the other side of the Derwent, whose Roman antiquity is proved by several monuments; and a large green stone vessel found here, with little images upon it, is supposed to have

(A) "See the dialogue of Lucian, entitled, *De Saltatione*, tom. ii. p. 265—317. edit. Reitz. The pantomimes obtained the honourable name of χειροσοφοι; and it was required that they should be conversant with almost every art and science. Burette (in the *Memoires de l'Academie des Inscriptions*, tom. i. p. 127, &c.) has given a short history of the art of pantomimes.

(B) "Ammianus, l. xiv. c. 6. He complains, with decent indignation, that the streets of Rome were filled with crowds of females, who might have given children to the state, but whose only occupation was to curl and dress their hair; and *jactari volubilibus gyris, dum exprimunt innumera simulacra, quæ finxere fabulæ theatrales.*"

have been formerly a Danish font for dipping infants; and has been since used at Bridekirk in the neighbourhood for their sprinkling.

The name of *Pap-castle* seems to be contracted from Pipard its owner: it is said to have been demolished, and the materials employed to build Cockermouth castle.

Mr Routh, in a letter to Mr Gale, thus describes the ruins discovered at Pap-castle, Jan. 16. 1741.

Camden's Britannia, Gough's edit.

"I made particular inquiry of the man in whose grounds they were discovered, and some of the neighbours present at the discovery. The close in which they lay is a little to the south of the fort, on the declivity of the hill to the river, and bounded on the west by a narrow lane, probably the *via militaris* continued; and is usually shown to strangers as the most remarkable here for finding Roman coins. They are the largest ruins ever known to be discovered in these parts: for they met with three walls besides the pavement; the first lay east and west, and was covered with earth near a foot high; parallel to it, at seven yards, they found a second; and between these two, about two yards deep (the height of the walls, which were six yards broad, and strongly cemented), they came to a pavement curiously laid with large flags, three quarters of a yard square, and two or three inches thick, as I measured them: but imagining there must be money under it, they covered it up till night, and then tore it all up. It was composed of flags of different thickness: under the thinner was a coarse strong cement, which caused them to be broken in taking up; but the thicker are pretty entire. Part of the wall stood on the floor, and the edge was secured by a fine red cement two inches thick, supposed to be intended to keep the floor dry. They imagined themselves at the corner of the building, the third wall standing at right angles with the first, and the second parallel to the stony lane, on which was an old hedge. On the floor they found a stone trough, or rather base of a pillar, about a foot high, and the hollowed part square, and two inches deep. They likewise found a small earthen patera, which I procured, of the fine red clay, beautifully smooth, with letters impressed on the bottom; but so defaced as not to be intelligible.—Some years ago, the man's father who found these ruins dug up a conduit. The owner had no coins, nor knew of any. One of his neighbours showed me a large brass one defaced."

Mr Routh, in another letter to Mr Gale, April 13. 1743, describes a fibula, a coin of Trajan, . . . IANO AVG. . . . P. M. Rev. the emperor seated on a pile of arms, a trophy before him, S. P. Q. R. OPTI . . . . S. C. and two oaken pieces of the adjoining timber of a house which appeared to have been burnt, in the gardens of Jerome Tully, Esq. of Carlisle. The earth as far as they dug was artificial, and antiquities are only found at a considerable depth.

Dr Stukeley says, the Roman castrum lies on the top of the hill above the village, and he traced its whole circumference, a bit of the Roman wall by the river side going to Wigton, and there the ditch is plainly visible, though half filled up with the rubbish of the wall. A subterraneous vault, floored with large slabs of freestone, was found in the pasture of the south-east angle. The name of *Boroughs* includes both closes where it stood; and they find stones and slates with iron pins in them, coins, &c. on the whole spot below it, towards the water-side. It was a beautiful and well chosen plan, on the south-west side of a hill, a noble river running under, and pretty good country about it. Coins of Claudius, Adrian, and a silver Geta, PONT. *rev.* PRINCEPS IVVENTVTIS. He supposes its ancient name *Derventio*, derived from the Derwent.

PAPAVER, the POPPY; a genus of plants belonging to the polyandria class, and in the natural method ranking under the 27th order, *Rhœadeæ*. See BOTANY and MATERIA MEDICA *Index*.

PAPAW, or PAPA-TREE. See CARICA, BOTANY *Index*.

PAPER.

PAPER is a word evidently derived from the Greek *παπυρος*, *papyrus*, the name of that celebrated Egyptian plant which was so much used by the ancients in all kinds of writing. It would be unnecessary particularly to describe the different expedients which men in every age and country have employed for giving stability to their ideas, and for handing them down to their children. When the art of writing was once discovered, stones, bricks, leaves of trees, the exterior and interior bark, plates of lead, wood, wax, and ivory, were employed. In the progress of society, men have invented the Egyptian paper, paper of cotton, paper manufactured from the bark of trees, and in our times from old rags.

The inhabitants of Ceylon, before the Dutch made themselves masters of the island, wrote on the leaves of the talipot. The manuscript of the bramins, sent to Oxford from Fort St George, is written on the leaves of a palm of Malabar. Herman speaks of another palm in the mountains of that country which produces leaves of several feet in breadth. Ray, in his History of Plants, vol. ii. book xxxii. mentions some trees both in India and America, the leaves of which are proper for writing. From the interior substance of these leaves they draw a whitish membrane, large, and somewhat like the pellicle of an egg; but the paper made by art, even of the coarsest materials, is much more convenient in use than any of these leaves.

The Siamese, for example, make two kinds of paper, the one black and the other white, from the bark of a tree called *Pliokkloi*. These are fabricated in the coarsest manner; but they can be used on both sides with a bodkin of fullers earth.

The nations beyond the Ganges make their paper of the bark of many trees. The other Asiatic nations within the Ganges, excepting those toward the south, make it of old rags of cotton cloth; but from their ignorance of the proper method, and the necessary machinery, their paper is coarse. This, however, is by no means the case with that made in China and Japan, which

which deserves attention from the beauty, the regularity, the strength, and fineness of its texture. In Europe they have discovered, or rather carried to perfection, the ingenious art of making paper with old rags, originally either from flax or hemp; and since this discovery the paper produced from our manufactures is sufficient for every purpose. And though these materials have been hitherto abundant, several philosophers have attempted to substitute other vegetable substances in their place. In the 6th volume of the Transactions of the Society for the Encouragement of Arts, we have an account of paper made by Mr Greeves near Warrington from the bark of willow-twigs; and it has been observed by a society of able critics, that hop-buds would probably answer this purpose better. The rags in common use for paper-making are a texture of supple and strong fibres separated by a lee from the bark of the plants. It would be in vain to employ the whole body of the plant, as this substance forms a very improper stuff for the operations of the paper-mill. From these principles we are directed in the choice of vegetable substances fit for the present purpose. The greater or less degree of purity in the materials is not absolutely necessary; for flax itself, without any preparation, could be made into paper; but it would be extremely coarse, and the bark of nettles or mallows would not bear the expence of labour. Although cotton be used in the fabrication of paper in the Levant, and perhaps in China, we are not to conclude that the down of plants in Europe, without the strength or suppleness of cotton, will answer the same purpose.

History.

The chief kinds of paper which merit attention in this work are, 1. The Egyptian paper; 2. The paper made from cotton; 3. Paper from the interior bark of trees or liber; 4. Chinese paper; 5. Japanese paper; 6. Paper made from asbest; and, 7. Paper made from linen rags.

1 Egyptian paper.

This is the famous paper used by the ancients, which was made of a kind of reed called *papyrus*, growing in Egypt on the banks of the Nile. According to Isidorus this paper was first used at Memphis, and Lucan seems to be of the same opinion,

Nondum flamineas Memphis connexere biblos
Noverat. PHARSAL. lib. iii. ver. 222.

Whatever truth may be in this, it is certain, that of all the kinds of paper used by the ancients, the papyrus was the most convenient, both from its flexibility and from the ease of fabrication. It was a present from nature, and required neither care nor culture.

It is not certain at what particular period the ancients began to make paper of papyrus; but there are several authorities which prove the use of it in Egypt long before the time of Alexander the Great.

Pliny, lib. xiii. cap. 11. gives a full description of the method of making this paper in Egypt. They divide, says he, with a kind of needle the stem of the papyrus into thin plates or slender pellicles, each of them as large as the plant will admit. These are the elements of which the sheets of paper are composed. The pellicles in the centre are the best; and they diminish in value as they depart from it. As they were separated from the reed, they were extended on a table, and laid across each other at right angles. In this state they were moistened by the water of the Nile, and while wet were put under a press, and afterwards exposed to the rays of the sun. "It was supposed that the water of the Nile† had a gummy quality necessary to glue these stripes together. This, says Mr Bruce, we may be assured is without foundation, no such quality being found in the water of the Nile; on the contrary, I found it of all others the most improper, till it had settled and was absolutely divested of all the earth gathered in its turbid state. I made several pieces of this paper both in Abyssinia and Egypt; and it appears to me, that the sugar or sweetness with which the whole juice of this plant is impregnated, is the matter that causes the adhesion of these stripes together; and that the use of the water is no more than to dissolve this, and put it perfectly and equally in fusion." When there was not enough of sugar in the plant, or when the water did not sufficiently dissolve it, the pellicles were united by a paste made of the finest wheat flour, mixed with hot water and a little vinegar, and when dried they were flattened and smoothed by the beating of a mallet.

† Pliny, lib. xiii. c. 12.

The size of this paper varied much; it seldom exceeded two feet, but it was oftentimes smaller. It had different names, according to its size and quality: The first was called *Imperial*, which was of the finest and largest kind, and was used for writing letters by the great men among the Romans. The second sort was called by the Romans the *Livian* paper, from Livia the wife of Augustus; each leaf of this kind was 12 inches. The third sort was called the *Sacerdotal* paper, and was 11 inches in size.

The paper used in the amphitheatres was of the dimensions of nine inches. But what was esteemed of greatest value in it, was its strength, whiteness, and polish. The ink, however, sunk less in paper highly polished; and therefore the characters were more liable to be effaced. When it was not carefully soaked in the first preparation, the paper brought a less price; because letters were with difficulty formed upon it, and it sent forth a disagreeable smell. To remedy this defect, the paper went through a new course of sizing and hammering; and the size used on that occasion was made of light bread steeped in boiling water, and passed through a filtering cloth. By this means the paper became in the highest degree united, and smoother than the finest linen. It was this paper which gave so long a duration to the works of the Gracchi, Tiberius and Caius, in their own hand-writing. "I have seen them (says Pliny) in the library of Pomponius Secundus, a poet and citizen of the first rank, near 200 years after they were written." We may add, that manuscripts of this paper still remain, which have undoubtedly been written 1000 or 1200 years ago. It appears from Pliny, that the Egyptians pasted together the pellicles of the papyrus by means of the water of the Nile; but that the polishing with ivory, and the operations of the hammer and the press, were added by the invention and industry of the Roman artists. The Egyptians seem to have known the use of size; but it is evident from the same author, that the Romans used a stronger size in the making of paper. Notwithstanding the care which was taken to give strength and consistency to the paper of Egypt, the leaves, although collected into a book, were too weak to support themselves; and for this reason it was a common practice, after every five leaves, to insert a leaf of parchment. There still remains in the abbey of St German de-pres a fragment of the epistles of St Augustine written in this manner. The manuscript is at least 1100 years old, and in a high state of preservation.

This paper was an important branch of commerce to the Egyptians, which continued to increase towards the end of the Roman republic, and became still more extensive in the reign of Augustus. The demand from foreign nations was often so great, as to occasion a scarcity at Rome; and we read in the reign of Tiberius of a tumult among the people in consequence of this scarcity. In a letter of the emperor Adrian, the preparing of the papyrus is mentioned as one of the principal occupations at Alexandria. "In this rich and opulent city (says he) nobody is seen idle: Some are employed in the manufactory of cloth, some in that of writing paper," &c. During the time of the Antonines, this commerce continued equally to flourish. Apuleius says, that he wrote on the paper of Egypt with a reed of the Nile prepared at Memphis.

The demand for this paper was so great towards the end of the third century, that when the tyrant Firmus conquered Egypt, he boasted that he had seized as much paper and size as would support his whole army.

St Jerome informs us, that it was as much in use in the fifth century when he flourished. The duty on the importation of this commodity had grown excessive towards the end of this or the beginning of the sixth century; and being abolished by Theodoric king of Italy, Cassiodorus, in the 38th letter of his 11th book, congratulates the whole world on the discharge of an impost on a merchandise so essentially necessary to mankind.

The fathers Montfaucon and Mabillon mention several fragments written on this paper in the sixth century. One of them was a charter of the emperor Justinian, entitled *Charta plenariæ securitatis*. Father Montfaucon saw in 1698, in the library of Julio Justiniani, three or four fragments of paper of Egypt of the same antiquity. And Mabillon speaks of some books of the Jewish antiquities by Josephus translated into Latin, which seemed to have been written in the same century, and which were preserved in the library of St Ambrose of Milan, but he had not seen the manuscripts. The same father mentions to have seen in the library of St Martin of Tours the remains of an old Greek manuscript of the paper of Egypt, and which appeared to him to be of the seventh century. He also believes that the copy of St Mark's gospel preserved in the register-office of Venice is written on the same paper, that it is the most ancient of any of the evangelical manuscripts, and may be supposed to be written at the latest in the fourth century.

According to the same antiquarian, the paper of Egypt was used in France and Italy, and other European countries, both for books of learning and public records; and there still remains, adds he, a great number of these in the archives of the church at St Dennis, at Corbie, in the abbey De Grasse, and in other convents.

It is probable, that the invention of paper made of cotton, of which we are afterwards to treat, insensibly destroyed the reputation and manufacture of the paper of Egypt; but it is still a question at what particular period the fabrication of the latter totally ceased. Eustachius, the learned commentator on Homer, assures us, that in his time in 1170 it was no longer in use; but Father Mabillon maintains, that many of the popish bulls were written on the papyrus in the 11th century.

The Count Maffei, in his *Istor. Diplomat.* lib. ii. *Biblioth. Ital.* tom. ii. p. 251. is decidedly of opinion, that the paper of Egypt was not in use in the fifth century. He considers all records written on this paper dated posterior to this period as not authentic; and the popish bulls mentioned by Father Mabillon appear to this learned person, as well as the copy of St Mark's gospel, to be written on paper manufactured from cotton. To reconcile in some measure these contradictory accounts, it may be observed, that on some particular occasions, and by some particular persons, the paper of Egypt might have been employed for several hundred years after it ceased to be of general use. Whoever wishes for a fuller account of the paper of Egypt, may consult among the ancients Pliny, lib. xiii. and Theophrastus, lib. iv. chap. ix. and among the moderns, Guilandinus, Scaliger, Saumaise, Kerchmayer, Nigrisoli; Father Hardouin in his edition of Pliny; Father Mabillon in his work *De re Diplomat.*; Montfaucon in his Paleography, and in his Collections; the illustrious Maffei in his *Istor. Diplomat.*; the count de Caylus in the Memoirs of the Academy of Inscriptions; and Mr Bruce in his Travels to discover the Source of the Nile.

It is generally supposed that the invention of the paper, called *charta bombycina*, supplanted the Egyptian paper in Greece. This paper is incomparably more lasting, and better calculated for all the purposes of writing. It is not precisely known at what period this art, which supposes a great variety of previous experiments, was first reduced to practice. The application of cotton to the purposes of paper-making requires as much labour and ingenuity as the use of linen rags; and for this reason, if we could determine the precise time when paper was made from cotton, we should also fix the invention of the art of paper-making as it is presently practised in Europe. Father Montfaucon proves, by incontestable authorities, that paper from cotton was in use in 1100. This paper, in the Greek language, is called χαρτη βομβυκινος, or βαμβακινος; for although βομβυξ is the Greek word for silk, yet in those times it was applied, as well as βαμβαξ, to cotton; and hence the Italians to this day call cotton *bambaccio*. 1 Paper made from cotton.

The most ancient manuscript of this paper which Father Montfaucon saw with the date, was that in the French king's library, written A. D. 1050; but as the manuscripts without date are infinitely more numerous than those which are dated, and as some conjecture can be formed concerning them from the manner of writing, this father believes some of these to have been written in the 10th century.

The researches of the same learned antiquarian amount almost to a proof that this paper was discovered towards the end of the ninth century or beginning of the tenth; for before the twelfth century it was commonly used in the eastern empire, and even in Sicily. Roger king of Sicily says, in a diploma written in 1145, that he had renewed

renewed on parchment a charter which had been written on paper of cotton, in the year 1100, and another which was dated in the year 1112. About the same time the empress Irene, in the statutes for some religious houses at Constantinople, says that she had left three copies of the same statutes, two in parchment and one in paper from cotton. From that period this paper was still more in use through all the eastern empire; and innumerable Greek manuscripts are found written on it in all the great libraries.

This discovery happened at a time when there seems to have been a great scarcity of parchment; for it was about this period that the Greeks erased the writings of Polybius, Diodorus of Sicily, and many valuable ancient authors, for the sake of the parchment.

It was the invention of this paper of cotton which destroyed the manufacture of the paper of Egypt; for, if we may believe Eustathius, who wrote towards the end of the 12th century, the latter paper had gone into disuse but a little before his time. We may easily believe, however, that this new invention, although of great advantage to mankind, was introduced by degrees.

The manufacture of this kind of paper has flourished in the Levant for many ages, and is carried on with great success even to this day. It is not necessary to say any thing farther, than that the paper produced from cotton is extremely white, very strong, and of a fine grain.

3 Paper from the interior bark of trees or liber.

This paper of the ancients was made from the white pellicle or inner coat found in many trees between the bark and the wood. The trees commonly in use were the maple, the plane tree, the elm, the beech, the mulberry, and most frequently the lindin-tree. The ancients wrote on this inner coat after they had separated it from the bark, beat, and dried it.

The fathers Mabillon and Montfaucon speak frequently of manuscripts and diplomas written on paper made from bark; and positively distinguish it from the Egyptian paper, because it was thicker, and composed of parts less adhering together.

There are many palm trees in India and America to which botanists have given the name *papyraceous*, because the natives have written with bodkins either on the leaves or the bark. Such is the American palm, called *tal* by the Indians; and of the same kind is the guajaraba of New Spain. Every palm, the bark of which is smooth, and the leaves large and thick, may be used for this purpose.

4 Chinese paper.

The art of making paper from vegetables reduced to stuff was known in China long before it was practised in Europe; and the Chinese have carried it to a degree of perfection hitherto unknown to the European artists. The fine paper in China is softer and smoother than that of Europe; and these qualities are admirably adapted to the pencil, which the Chinese use in writing. Several kinds of their paper discover the greatest art and ingenuity, and might be applied with much advantage to many purposes. They are capable of receiving, for example, the impression of types; and both maps and prints have been executed with success on the Chinese paper.

The different sorts of paper vary in China according to the materials of which they are composed, and to the different manner of manufacturing those materials. Every province has its peculiar paper. That of Sechwen is made of linen rags as in Europe; that of Fo-kien, of young bamboo; that of the northern provinces, of the interior bark of the mulberry; that of the province of Kiang-nan, of the skin which is found in the webs of the silk-worm; finally, in the province of Huquang, the tree chu or ko-chu furnishes the materials with which they make paper.

The method of fabricating paper with the bark of different trees is nearly the same with that which is followed in the bamboo. To give an idea, therefore, of the manner of manufacturing the interior barks of the mulberry, the elm, and the cotton-tree, it will be sufficient to confine our observations to the bamboo.

The bamboo is a kind of cane or hollow reed, divided by knots; but larger, more elastic, and durable than any other reed.

The whole substance of the bamboo, composed of filaments, and a great abundance of fibrous materials, is employed in this operation. The shoots of one or two years, nearly the thickness of a man's leg, are preferred. They strip the leaves from the stem, cut them into pieces of four or five feet long, make them into parcels, and put them into water to macerate. As soon as they are softened, which generally happens in five days, they wash them in pure water; put them into a dry ditch; cover them with lime for some days, which they water for the purpose of slacking: they wash them carefully a second time; cut every one of the pieces into filaments, which they expose to the rays of the sun to dry and to bleach them. After this they are boiled in large kettles; and then reduced to stuff in mortars of wood, by means of a hammer with a long handle, which the workman moves with his foot.

The stuff being thus prepared, they take some shoots of a plant named *koteng*, which, steeped in water four or five days, is reduced to an unctuous or glutinous substance; and when they proceed to make the paper, this is mixed with the stuff in certain exact quantities, for on this mixture depends the goodness of the paper.

When the extract from the koteng is mixed with stuff of the bamboo, the whole mixture is beat together in mortars till it becomes a thick and viscous liquor. This is poured into large tubs or reservoirs, so exactly framed as that no part of the liquor can escape.

The workmen after this plunge their forms into the liquor; take out what is sufficient for a sheet of paper; which immediately, from the glutinous substance, becomes firm and shining; and is detached from the form by turning down the sheet on the heap of paper already made, without the interposition of pieces of woollen cloth, as in Europe.

In order to dry this paper, they have a hollow wall, the two fronts of which are smooth and extremely white. At the extremity of this wall is placed a stove, the pipes of which are carried in a circular manner through the whole empty space. The sheets of paper are laid on the surface, to which they adhere till they come over them with a soft brush; and after they are dry, it is easy to distinguish the side which received impressions from the brush from that which adhered to the wall. By means of this stove the Chinese dry their paper as fast as they can make it; but it is only in cold seasons, or in certain

certain provinces, that they find this expedient necessary.

The Chinese paper must be dipped in a solution of alum before it can take either ink or colours. They call this operation *faner*, from the Chinese word *fan*, which signifies alum. The following is the manner of preparing this solution: Six ounces of isinglass cut very small is put into boiling water, and constantly stirred, that it may dissolve equally. When the isinglass is wholly dissolved in the water, they throw in twelve ounces of calcined alum, which is also stirred till it is completely dissolved and mixed with the isinglass. This composition is afterwards poured into a large and deep bason, at the mouth of which is a little round piece of wood; the extremity of every sheet of paper is fixed in another piece of wood, with a slit made to receive it; by means of this equipage they plunge the sheet of paper into the composition of alum and isinglass; and when it is fully penetrated, they draw it out, making it glide over the little round piece of wood. The long piece of wood which holds the sheet by one end, and keeps it from tearing, is afterwards suspended with it on a wall till it is sufficiently dry.

The Chinese give the paper intended for different purposes different preparations. We shall confine our observations to the silver colour which they give to some paper. They take two scruples of paste made of cows hide, one scruple of alum, and a pint of water: the whole is boiled on a slow fire till the water be evaporated. The sheets of paper are then stretched on a smooth table, and covered over with two or three layers of this paste. They take afterwards a certain quantity of talc, washed and boiled in water, with the proportion of one-third of alum; this is dried, reduced to a powder, passed through a sieve, boiled a second time in water, dried in the sun, and again passed through the sieve. This powder is spread equally over the sheets of paper, prepared as we mentioned above; and then they are dried slowly in the shade.

The sheets of paper, covered in this manner with talc, are laid upon a table, and rubbed with a little cotton; which fixes a certain quantity of the talc in the paper, and carries off the overplus to be used on another occasion. By means of this composition the Chinese draw all manner of figures on their paper.

Formerly the Chinese wrote with a bodkin of iron on tablets of bamboo; afterwards on satin with a pencil; and during the dynasty of their tyrants, about 160 years before Christ, they discovered the art of making paper.

The paper made from the bamboo is sufficiently white, soft, closely united, without the least inequality on the surface to interrupt the motion of the pencil, or to occasion the rising of the materials which compose it. Meanwhile every kind of paper made from the bamboo or the bark of trees, is readier to crack than that made in Europe; besides, it is more susceptible of moisture, and sooner destroyed with dust and worms. To obviate this last inconveniency, they are obliged frequently to beat their books in China, and to expose them to the sun. It may be observed, however, that the Chinese paper, employed for various purposes in Europe, has been preserved for a long time without receiving damage either from moisture or insects.

5 Japanese paper.

According to Kempfer, the bark of the *morus papifera sativa*, or true paper tree, is chiefly employed for making paper in Japan. Every year after the fall of the leaves, which happens in the tenth month, corresponding to our December, the Japanese cut the young shoots of this tree into pieces of about three feet, collect them into parcels, which they boil in water into which they have cast a certain quantity of ashes. If the wood is dry, they take care to steep it 23 hours in water before it is boiled. The parcels are kept in a close copper till the bark at the extremity of the shoots is separated from the stem about half an inch; they are then cooled; and the bark alone is fit for making paper. They begin by a preparation which consists of cleaning the bark, and separating the good from the bad. For this purpose they steep it in water three or four hours; and as soon as it is softened they scrape off with a knife whatever is blackish or green, and at the same time separate the strong bark of a year's growth from the slender which covers the young shoots. The first of these gives the whitest and best paper. If there is any of the bark of more than a year's growth, it is laid aside for the coarsest.

After the bark has been culled and cleaned in this manner, it is boiled in a clear ley till the matter is of that consistency, that, being touched gently with the finger, it draws off in the form of hairs, or like a collection of fibres. During the time of boiling it is constantly stirred with a strong reed, and the waste by evaporation supplied from time to time with additional quantities of the clear ley. To make this ley, they put two pieces of wood across the mouth of a tub, cover them with straw, on which they lay a bed of ashes a little moistened; and pouring boiling water on the ashes, the salts contained in them are carried down to the tub. This is what is called a *clear ley*.

After the bark is in the condition we have just now stated, it is washed with great care; for on this washing depends in a great measure the goodness of the paper. It is put into a kind of sieve through which the water can flow freely; and great care is taken to turn it with the hand till it is sufficiently diluted, and reduced to soft and tender fibres. For the finest paper a second washing is requisite, and a piece of cloth is used instead of a sieve.

When the bark is washed, it is laid on a strong and smooth table, and beat with a kind of baton of hard wood till it is reduced to a proper consistency. It becomes indeed so soft, that it resembles paper steeped in water.

The bark prepared in this manner is put into a narrow tub, with a glutinous extract from rice and the root oreni, which is very viscous. These three substances, mixed together, are stirred with the reed till they form a liquor of an equal and uniform consistency. This composition is poured into tubs similar to those used for filling the forms in our paper mills.

As soon as the sheets are made and detached from the form, they are laid in a heap on a table covered with a double mat. A small chip of cane is placed betwixt every sheet. This piece of cane jutting out, serves to distinguish the sheets, and afterwards to raise them. Every one of the heaps is covered with a plate or thin board of the exact size of the paper. In proportion as the paper dries, or is able to bear it without danger of being compressed into one mass, they lay on on additional weights. This pressure, intended to carry off any unnecessary moisture, is continued for 24 hours, when the sheets are suspended, by means of the little pieces of reed, to long plants, in the open air, till they are completely dried.

The extract from rice is made in an unvarnished earthen pot. The pot is agitated at first gently, then more briskly: new water is poured in, and then it is filtered through a linen cloth. The finishing of the process is determined by the viscosity of the substance.

The infusion of the root oreni is made in the following manner: The root peeled and cut into small pieces, is infused into water for one night, during which time it communicates a viscosity sufficient for the purpose to which it is applied.

The Japanese paper is of such prodigious strength, that the materials of which it is composed might be manufactured into ropes. There is sold at Serige, the capital city of the province of Japan of that name, a kind of it fit for bed hangings and wearing apparel; resembling so much stuffs of wool and silk, that it is often taken for them. The following is Kempfer's catalogue of trees used in Japan for the manufactory of paper. 1. The true paper tree, called in the Japanese language *kaadsi*, Kempfer characterizes thus: *Papyrus fructu mori celsæ, sive morus sativa foliis urticæ mortuæ cortice papifera.* 2. The false paper tree, called by the Japanese *katsi kadsire;* by Kempfer, *papyrus procumbens lactescens folio longo lanceato cortice chartaceo.* 3. The plant which the Japanese call *oreni* is named by Kempfer *malva radice viscosa flore ephemero magno punico.* 4. The fourth tree used for paper is the *futokadsura*, named by Kempfer *frutex viscosus procumbens folio telephii vulgaris emulo fructu racemoso.*

The description of these trees, given more particularly by Kempfer than the limits of this work will permit, may be of great service to lead botanists to discover the European plants and shrubs adapted, like the Japanese, for the fabrication of paper.

Before finishing our reflections on this part of the subject, it will be proper to give a just idea of the attempts which have been made to increase the original materials of paper in Europe.

A slight attention to the process in China in reducing the bamboo to a paste by a careful and ingenious analysis, and to the long and proper method of the Japanese of separating the principal fibres of the bark of the mulberry, will show the absurdity not only of taking plants without any kind of choice, but of giving them no preparation except that of pounding them with mallets.

With a proper selection, and good principles, it appears not improbable that many of the European plants might be used with great advantage in constructing several kinds of paper.

It is evident that the materials used by the Chinese require less labour and preparation than the stuff of linen rags. The sheets of the Chinese paper are easily detached from the form; they are laid in heaps without the interposition of pieces of woollen cloth; the superfluous water is immediately discharged; and they require not, as in Europe, the vigorous action of presses to unite the parts more closely together.

6 Paper made from asbestos.

The asbestos is a fibrous substance of little strength, the threads of which are easily broken. See MINERALOGY *Index*. This substance has the peculiar property of supporting the action of fire without receiving any damage: whence pieces of cloth and garters made of it are incombustible. From the knowledge of this property paper has been made of the asbestos. Dr Brukman, professor at Brunswick, published the natural history of this fossil; and four copies of his book, in the library of Wolfenbuttle, are on this paper.

The manner of fabricating this paper is described by M. Lloyd in the Philosophical Transactions, N° 166. A certain quantity of the asbestos is pounded in a mortar of stone till it be reduced to a substance like cotton. All the parts of earth or stone remaining in the asbestos are then taken off by means of a fine sieve, and it is formed into sheets of paper by an ordinary paper mill. Mixing it with water reduces it to stuff; only, as it is heavier than that from linen rags it requires to be continually stirred when they are taking it up with the frames. The only excellence of this paper is, that the writing disappears when it is cast into the fire. It must be observed, at the same time, that as it is of a slender consistency, and easily torn, it is more an object of curiosity than use.

7 Paper made from rags.

This paper is manufactered through all Europe of linen rags collected in the cities and in the country. This kind of paper was utterly unknown to the ancients. The *libri lintei* mentioned by Livy, I. lib. iv. Pliny, XIII. c. xi. and by other Roman writers, are demonstrated by Guilandin, in his commentary on Pliny, &c. to have been written on pieces of linen cloth, or canvas prepared in the manner of painters.

But it is not sufficient to be certain that paper from linen is a modern invention; it is necessary to know by what nation, and at what period, it was discovered. Polydore Virgil, *De Inventoribus Rerum*, C. II. c. viii. confesses his ignorance of these facts. Scaliger, without any kind of proof, gives the glory to the Germans; and Count Maffei to the Italians. Other writers ascribe this honour to some Greek refugees at Basil, to whom the manner of making paper from cotton in their own country had suggested the idea. Du Halde is persuaded that Europe derived this invention from the Chinese, who, in several provinces, make paper of rags nearly in the same manner that we do. But this invention was practised by the Europeans before they had any communication with China, and before the taking of Constantinople, at which time the Greek refugees were supposed to have retired to Basil. The precise time of this discovery in Europe is not exactly known. Father Mabillon believes that it was in the twelfth century; and cites a passage of Pierre de Clugny, born A. D. 1100, to prove it. The books which we read every day, says that abbé in his treatise against the Jews, are written on sheep and calves skins; or on oriental plants; or, finally, *Ex rasuris veterum pannorum.* If these last words signify paper, such as we use, there were books of it in the twelfth century. But this citation is the more to be suspected, as Montfaucon himself, after the minutest search in France and Italy, could find no book on this paper antecedent to the death of St Louis, A. D. 1270.

The epocha of this invention was not determined till 1762, M. Mierman having proposed a reward to the person who could procure the most ancient manuscript written on this kind of paper. The collection of all the memoirs sent to him along with the manuscripts was published

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published at the Hague in 1767: and it appeared that this paper had been used in Europe before the year 1300.

In 1782 the Abbé Andrez published a work entitled *Dell' Origine, Progressi, e Stato attuale d'Ogni letteratura;* wherein he speaks of the discovery of many kinds of paper, and particularly of that made of rags. The Abbé Andrez maintains, that paper made from silk was very anciently fabricated in China, and in the eastern parts of Asia; that the art of making this paper was carried from China to Persia about the year 652, and to Mecca in 706. The Arabs substituted cotton, the commodity of their own country, in place of silk or rather bamboo. This paper of cotton was carried into Africa and Spain by the Arabs. The Spaniards, from the quantity of linen to be found in the kingdom of Valencia, seem first to have adopted the idea of using linen rags; and the most ancient paper of this kind is of Valencia and Catalonia. From Spain it passed into France, as may be learned from a letter of Joinville to St Louis about the year 1260. It is discovered to have been in Germany in 1312, and in England in 1320 and 1342. In consequence of the paper made from cotton in the Levant, the paper from linen was introduced much later into Italy. See the work of Abbé Andrez, printed at Parma, 1782, in 8vo; and Mierman's Collection, published at the Hague.

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To give a concise view of this subject, it will be necessary to proceed with all the important parts of the operation in their order.

8
The selection of rags.

The selection of the rags, is the arranging of them into different lots, according to their quality and to the demand of the paper mill. In general this selection is very much neglected: The degrees of fineness and whiteness, distinguished with little care, are thought to be the only objects of importance; whereas the hardness and softness, the being more or less worn, are much more essential in this selection. It is certain, that a mixture of soft and hard rags occasions much more loss in the trituration than a difference in point of fineness or of colour. This exactness in the selection is still more necessary where cylinders are used instead of mallets. We cannot do better than to give the method practised in Holland as worthy of imitation.

They begin by a general separation of the rags into four lots; superfine, fine, middle, and coarse. These lots are given to selectors, who subdivide each of them into five chests. They have besides a bench, on which is fixed vertically a hook, and a piece of scythe which is terminated by a crooked point.

The person, for example, who has the charge of the fine lot, puts into one of the chests the hard rags, or those which are little used, into another the soft, into a third the dirty, into a fourth those which are stitched or hemmed, and finally, into the fifth the superfine rags which happen to be among the fine.

After this process, the women who have the charge of it are at extreme pains to pick out every kind of sewing, and especially the knots of thread and the hems, by means of the hook or scythe which they have under their hands. They take care also by the same means to cut and reduce the rags exactly by the warp and the woof into small pieces. It is of great advantage to cut or tear the pieces of rags by a thread, whether it be by the warp or woof; because if it is done obliquely, many of the ends are lost in the operation.

When they have selected a certain quantity of each of these subdivisions, they are placed on an iron grate, which covers a large chest where they are beat, and otherwise turned, till the filth and dust pass through the bars of the grate and fall into the chest.

The number of lots in the selection of rags must be proportioned to the mass from which the selection is made, and to the kinds of paper produced by the mill. Some mills, the work of which is considerable, make nine lots of their rags, five of which respect the fineness, and the rest the cleanness and the colour. In ordinary mills there are only four lots, and in some two.

We have already observed, that the selection which regards the hardness of the materials is the most essential; because it is of great importance to obtain stuff composed of equal parts, and without any loss. But it is necessary to add, that the fineness and beauty of the paper depend in some cases on a selection not rigorous. Thus, for example, it is of great service to allow the middling to retain some part of the fine, and the fine some part of the superfine; for without this the inferior kinds of paper can never be of great value. The most common fault is to mix the rags of the inferior lots with the superior; which though it augments the quantity of paper, is extremely injurious to the quality. It does much better to mix parts of the superior lots with the inferior. It is the want of attention to this mixture which makes some paper mills excel in the superior sorts of paper, while the inferior kinds are of a very bad quality.

The selection of rags being made with exactness, however, and the lots being fermented and triturated separately, the mixture may be made with much greater advantage when they are both reduced to stuff; always taking care that it be in the same proportion as if it were in the state of rags, and only in the manner which we just now mentioned; for the inferior sorts gain more in beauty and quality by this mixture than is lost in stuff; whereas if the fine stuff receives a certain quantity of the inferior, the paper is more damaged in its value than increased in quantity. In this manner the interest of the manufacturer, as in all cases, is intimately connected with the goodness of his commodities.

9
The washing and fermentation of rags.

In some mills the place for fermentation is divided into two parts, one of which serves for washing away the filth from the rags. After allowing them to steep for some time in a large stone vat, they stir them, and pour in fresh water till the impurities connected with the rags run over. When they are as clean as they possibly can be made with this kind of washing, they are laid in a heap to putrefy. In this condition they experience a degree of fermentation, which is first discovered by a mouldiness of the different pieces of cloth. Afterwards the mass grows warm; and then it is of great consequence to attend to the progress of this heat, in order to moderate its effects: for this purpose, the middle of the heap, where the fermentation is strongest, is turned out, and *vice versa*. In mills where mallets are used, the putrefaction is carried to a great height, which is frequently attended with two inconveniences. The first is, that

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that a part of the rags is reduced to an earthy substance, which is found in great abundance about the cutting table, as we shall afterwards have occasion to see. But besides this waste, excessive fermentation makes the stuff incapable of sustaining the action of the mallets till it is equally pounded. A paper made from a stuff too hard and too little fermented, is coarse and ill compacted; that made from rags too much fermented, is composed of fibres without softness and without strength.

The second inconveniency is, that the rags turn greasy by too much fermentation, and of consequence it is very difficult to separate and reduce them by all the washings of the trituration.

We shall not describe the form of the place for fermentation, because in different paper works these places are of different constructions: it is sufficient to say, that they are all placed in low situations and made very close. The selected rags are placed in them in heaps, and watered from time to time to bring on the fermentation. In different paper mills they practise different methods in the putrefaction of their rags.

In certain provinces in France, they lay in the place for putrefaction a heap equivalent to what the mill can triturate in a month. When this is equally and sufficiently moistened by means of moveable pipes, they cover it with an old heap, which has lain a month in a state of fermentation. When this old heap is exhausted by the mill, the new one becomes a covering to another, and so on. From this detail it is easy to perceive, that there must be near three weeks difference of putrefaction in the same heap, and also that in this method there is no allowance for those seasons in which the fermentation advances more rapidly.

In general the putrefaction goes on more slowly in proportion to the fineness of the rags. But when, on any occasion, it advances more rapidly than the demand from the mill, the rags are turned over and watered, to stop the fermentation and prevent the bad effects.

All the inconveniences attending the excess of putrefaction are remedied in Holland by machines which triturate the rags without having recourse to it; and their success in this manner of preparing the stuff has attracted the notice of the French artists, some of whom have adopted with advantage the Dutch machinery.

Meanwhile, it is possible to carry the method of putrefaction to much greater perfection; and several manufacturers have made attempts so well concerted, as to deserve the attention of those who study the subject.

In the neighbourhood of Brussels some paper manufacturers, who have constructed their mills after the Dutch plan, have still found it necessary to putrefy their rags; but, at the same time, they have an excellent method for moderating the effects of this putrefaction. In the great galleries connected with the buildings of the paper mill, they have constructed a continuation of chests, capable each of them of containing a certain quantity of rags; for example, the quantity which the cylinder can triturate in one day. The number of chests is equal to the number of days which the rags in any season require for putrefaction; and the number actually employed is greater or less according to the season. In prosecuting this plan, they lay a heap of rags in one chest, as often as they take one from another. It should also be observed, that, for the sake of the fermentation, the rags are first moistened in a large hollow stone before they are arranged into the chests.

The peculiar advantages of this method are, the equal fermentation of the rags, without any part of them being weakened; great ease in washing them; and it is even pretended, that a less degree of fermentation renders the impurities and the discoloured parts both of hemp and linen more soluble, and consequently the stuff of a purer white.

10 Cutting table.

When the rags are reduced to a proper state of putrefaction, they are carried to the cutting table, which is placed on solid tressels, and enclosed on three sides to contain the rags cut in it. Before the table is fixed vertically a part of the blade of a scythe, the edge of which is turned from the operator. This workman, in a situation rather elevated, takes from the left side a handful of the putrefied rags, and arranging them the long way, gives them a gentle twist, presses the half-formed rope against the blade of the scythe, and, in the manner of sawing, cuts it into three or four pieces, which he throws to the right side of the table. In this operation the rags lose part of their filth, and especially of the earthy particles occasioned by too much putrefaction.

11 Mills for triturating the rags.

When the rags have been submitted to all the foregoing operations, they are in a condition to be reduced into a fibrous stuff, of which the paper is made. To obtain this stuff, mills are constructed on different principles. Those which have been used for a long time over all Europe, and which by a statement in the *Encyclopédie Methodique*, published at Paris in 1789, are still used in France, are mills with mallets. But the mills invented by the Dutch, and used in the neighbouring provinces, and, excepting one instance, in every part of Great Britain, are mills with cylinders or rollers. In the former of these, the mallets are raised by notches fixed at convenient distances in a large circular beam of wood. The teeth fixed on the end of the mallet fall into a corresponding gap made the whole breadth of the plate, and the strokes are repeated till the rags are reduced to a proper consistency. On supplying the vat with water, and carrying off all the impurities, the operation is nearly similar to that in the mills with cylinders.

Such is the nature of what may be called the *old method of making paper*. It was proper to speak of this old method, because at one time, and that not very distant, it universally prevailed. That it was inferior to that now in practice, seems very evident; and that the rotting of the rags was peculiarly absurd, cannot be denied, as the paper made of fermented stuff could neither be so strong nor so durable as that which is made in the common way without putrefaction. The only kind of paper that, with any propriety, could be made from putrefied stuff, was pasteboard; but we are informed by the most intelligent papermakers in Britain, that they seldom or never even putrefy the rags or ropes of which pasteboard is made. It will now be requisite to state the method presently in practice, with the improvements lately made in the art.

12 The duster.

The duster is made in the form of a cylinder, four and a half feet in diameter, and five feet in length. It is altogether covered with a wire net, and put in motion by its connection with some part of the machinery. A

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convenient quantity of rags before the selection are enclosed in the duster, and the rapidity of its motion separates the dust from them, and forces it through the wire. It is of considerable advantage to use the duster before selection, as it makes that operation less pernicious to the selectors.

The selection is performed much in the same manner as we have already described; only it is found more convenient to have the tables for cutting off the knots and stitching, and for forming them into a proper shape, in the same place with the cutting table. The surface both of these and of the cutting table is composed of a wire net, which in every part of the operation allows the remaining dust and refuse of every kind to escape.

The rags, without any kind of putrefaction are again carried from the cutting table back to the duster, and from thence to the engine, where, in general, they are in the space of six hours reduced to the stuff proper for making paper. The hard and soft of the same quality are placed in different lots; but they can be reduced to stuff at the same time, provided the soft be put somewhat later into the engine.

13 Description of a paper mill.

The engine is that part of the mill which performs the whole action of reducing the rags to paste, or, as it may be termed, of trituration. The number of the engines depends on the extent of the paper work, on the force of water, or on the construction of the machinery.

It will afford a sufficient idea of the work, to give in detail a description of the different parts of the engine.

Plate CCCCIV. fig. 1.

Figure 1. represents the chapiter which covers the roller. It is four feet three inches in length, and two feet eight inches in breadth. The superior part is pierced with two openings running crosswise, 1, 2, 3, 4, into which enter the chesses, or wicker frames, figures 6. and 7.; the first, made of wire cloth, enters into the opening 3 and 4; the second made of hair cloth, and strengthened with several cross bars of wood, enters into the opening 1, 2, serves to retain the small pieces of rags which escape through the first, and prevents them from falling into the dalot or hole-scupper, fig. 2. This hole-scupper is placed across the vat of the engine, parallel to the axle of the roller; the part *g* enters into the notch *c* of the chapiter; and the extremity *h* enters into the opening *k* of the tunnel *k l* (fig. 3.), by which means the water dashed through the wicker frames by every revolution of the roller is precipitated into the canal *f h*, and loses itself below the engine. The figures 4, 9, and 10, represent the roller in perspective, in plane, and in profile. It is two feet in diameter, and two feet three inches in length. The trundle head A is 16 inches in diameter, about half as much in length, and furnished with seven spindles of iron, which are screwed to the end of the trundle head, made also of iron. The teeth or blades of the roller are 27 in number, and fitted strongly into the wood which composes its body, parallel to its axis. They are of that thickness as to leave as much empty space as they occupy. The exterior face of each of the blades should be made round, and divided into two parts, with a longitudinal motion, as in the profile *a a a*, fig. 10.

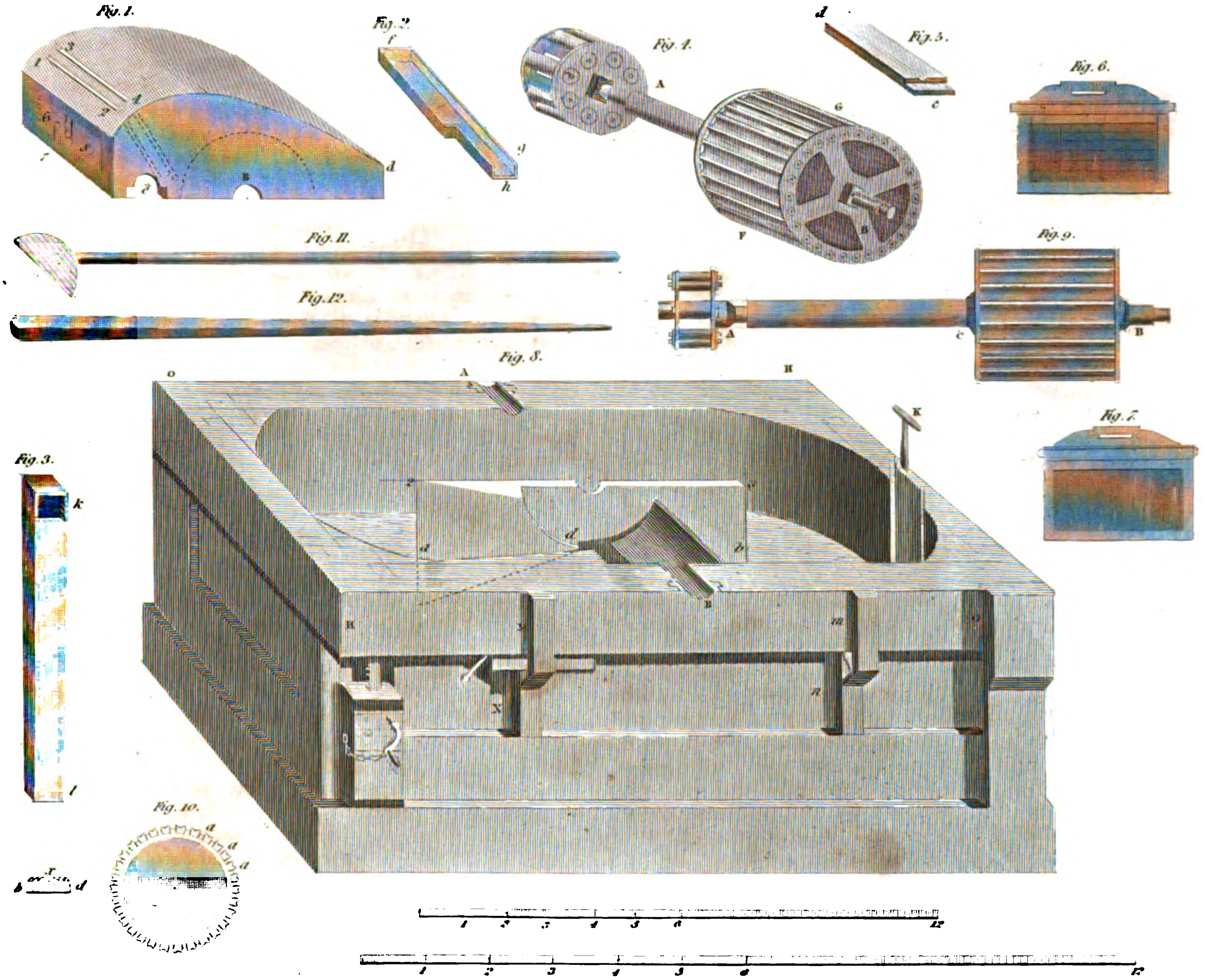
The axis AB of the roller (fig. 4. and 9.) has two parts perfectly rounded in A and in B, which perform the office of pivots. These pivots rest in the sockets A and B (fig. 8.) in the middle of the levers OAH and OBH. It is by means of these levers that they raise at pleasure, or lower the axis of the roller, and fit it exactly, and in a parallel manner, to the plate. The plates (see fig. 5.) are made of steel cut into channels, in such a manner as to correspond with the blades of the roller. Their channels are not perpendicular, but oblique; and there are two rows of them, *b x*, *x d*, consisting of seven or eight blades each on one plate.—Those in *b x*, for the purpose of changing the plate, lie in an opposite direction to those in *x d*. The levers are kept in their position near the vat by bands of iron, MN and *m n*; between which they are made higher or lower by the cogged wheel H, which supports one of the extremities. Wedges N *n* are likewise employed to fix the levers at a convenient height above the plates. Finally, Every vat is supplied with a small slide door, which is occasionally raised to carry the prepared stuff by means of the scuppers of wood to the general repositories.

14 Working of the engine.

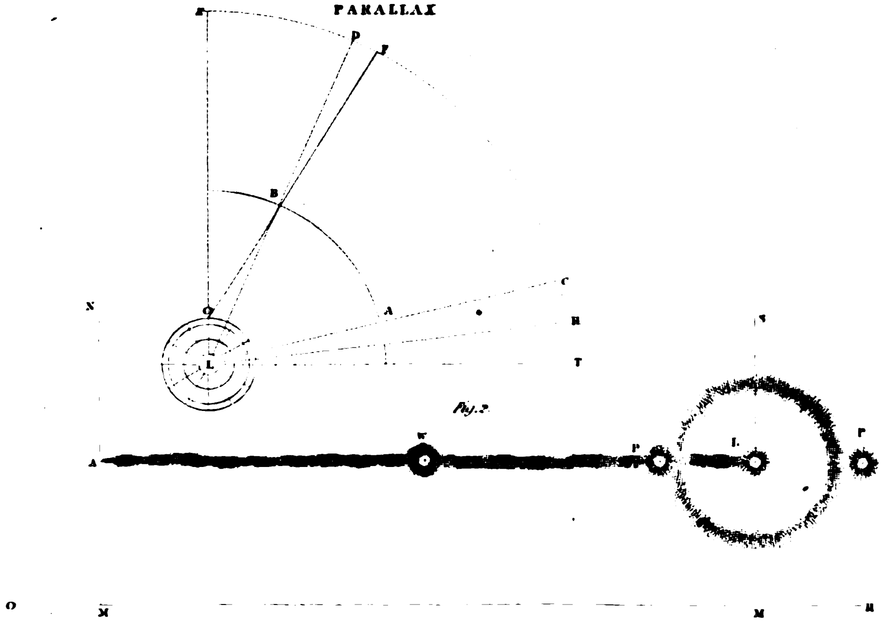
Fig. 5. is placed in the vat fig. 8.; the roller (fig. 4.) is placed above it in such a manner that the pivots rest in the sockets of the levers; the scupper (fig. 2.) and the chapiter are disposed in the manner above mentioned. The vat is charged with a proper quantity of rags, and fresh water is admitted by a spigot placed at one of the corners. In this situation, when the engine is put in motion, the roller turning upon its axis draws the water and the rags by the least inclined plane, and making them pass between its blades and the channels of the plate, dashes them against the chapiter and the wicker-frames; and, in short, part of them falls back into the vat, and returns into the circulation. The cause of this circulation is evidently the continual void occasioned by the movement of the roller on the one side, and the return of the water and the stuff on the other.

As all the rags are not thrown towards the part B *d* of the chapiter, from whence they might fall back into the vat, but a part of them to a greater distance; it is necessary to have the wicker frames formerly described, not only to prevent their loss, but to allow the dirty water to escape. The spigot at the corner of the vat continually supplies this waste of water. This operation would be sufficient to whiten the rags, although the rollers were raised considerably from the plate; and therefore the force and action of the rollers reducing them to stuff must be much more effectual. It requires great skill to conduct the engine, whether it be with regard to the first quantity, to the proper time for adding the softer rags, to the augmenting or diminishing the water in proportion to the trituration; or, finally, to knowing exactly when the stuff is reduced to a proper consistency.

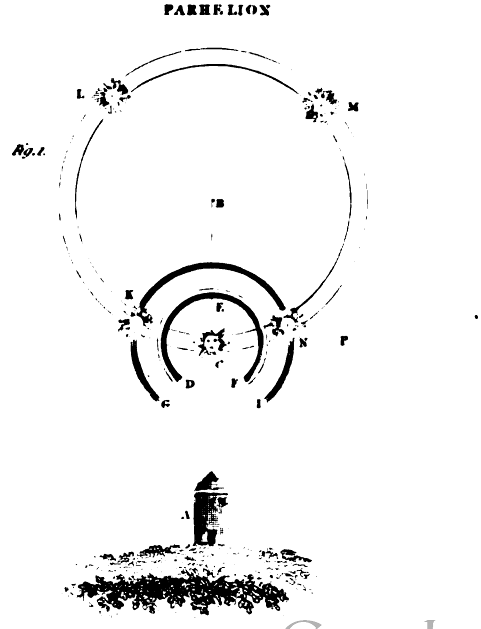
In the paper manufactory at Montargis, it was attempted to introduce rollers of the greatest strength and the least weight possible, in order to give them the greater rapidity; but the experiment did not succeed: the rollers of prodigious rapidity were found to produce stuff neither in greater quantity nor of superior quality. The most experienced artists have established a proportion between the motion of the roller and the greater or less resistance of the rags. And the Dutch, who have arrived at very great perfection in this art, have followed a method totally different from that practised at Montargis. A roller in Holland complete in all its parts



PARALLAX



PARHELION



parts weighs nearly 30 hundred weight; and they find this necessary for cutting the rags, especially if they have not been putrefied. In proportioning the rapidity to the resistance, they have also discovered, that a slow motion is preferable to a rapid one. The rollers at Saardam, by calculation made from the different parts of the machinery, make about 68 revolutions in a minute; those at Montargis about 166.—In Holland, too, this trituration of the rags is divided into two distinct operations, performed by rollers constructed on different principles: the first of them, for cutting the rags and preparing for the other, is furnished with blades of steel without any moisture, and with a considerable space between them; the second, intended to reduce the stuff to the proper consistency, has a greater number of blades, composed of a mixture of brass and copper. The mills with rollers are in every respect superior to those formerly in use with mallets. Two Dutch rollers of the construction we have just now described will prepare as much stuff in the same time as 24 mallets; they require infinitely less room; they do it without putrefaction, and as they do it in less time, and with less water, they occasion much less waste of the stuff.

When the stuff is brought to perfection, it is conveyed into a general repository, which supplies the vat from which the sheets of paper are formed. This vat is made of wood, and generally about five feet in diameter, and two and a half in depth. It is kept in temperature by means of a grate introduced by a hole, and surrounded on the inside of the vat with a case of copper. For fuel to this grate, they use charcoal or wood; and, frequently, to prevent smoke, the wall of the building comes in contact with one part of the vat, and the fire has no communication with the place where they make the paper.

Every vat is furnished on the upper part with planks, enclosed inwards, and even railed in with wood, to prevent any of the stuff from running over in the operation. Across the vat is a plank which is called the *trepan*, pierced with holes at one of the extremities, and resting on the planks which surround the vat.

The forms or moulds are composed of wire-cloth, and a moveable frame. It is with these that they fetch up the stuff from the vat, in order to form the sheets of paper. The sides of the form are made of oak, which is previously steeped in water, and otherwise prepared to prevent warping. The wire-cloth is made larger than the sheet of paper, and the excess of it on all sides is covered with a moveable frame. This frame is necessary to retain the stuff of which the paper is made on the cloth; and it must be exactly adapted to the form, otherwise the edges of the paper will be ragged and badly finished. The wire-cloth of the form is varied in proportion to the fineness of the paper and the nature of the stuff.

The felts are pieces of woollen cloth spread over every sheet of paper, and upon which the sheets are laid, to detach them from the form, to prevent them from adhering together, to imbibe part of the water with which the stuff is charged, and to transmit the whole of it when placed under the action of the press. The two sides of the felt are differently raised: that of which the hair is longest is applied to the sheets which are laid down; and any alteration of this disposition would produce a change in the texture of the paper. The stuff of which the felts are made should be sufficiently strong, in order that it may be stretched exactly on the sheets without forming into folds; and, at the same time, sufficiently pliant to yield in every direction without injury to the wet paper. As the felts have to resist the reiterated efforts of the press, it appears necessary that the warp be very strong, of combed wool, and well twisted. On the other hand, as they have to imbibe a certain quantity of water, and to return it, it is necessary that the woof be of carded wool, and drawn out into a slack thread.—These are the utensils, together with the press, which are used in the apartment where the sheets of paper are formed.

15 The fabrication of paper.

The vat being furnished with a sufficient quantity of stuff and of water, two instruments are employed to mix them; the one of which is a simple pole, and the other a pole armed with a piece of board, rounded and full of holes. This operation is repeated as often as the stuff falls to the bottom. In the principal writing mills in England, they use for this purpose what is called a *hog*, which is a machine within the vat, that, by means of a small wheel on the outside, is made to turn constantly round, and keep the stuff in perpetual motion. When the stuff and water are properly mixed, it is easy to perceive whether the previous operations have been complete. When the stuff floats close, and in regular flakes, it is a proof that it has been well triturated; and the parts of the rags which have escaped the rollers also appear.

After this operation the workman takes one of the forms, furnished with its frame, by the middle of the short sides, and fixing the frame round the wire-cloth with his thumbs, he plunges it obliquely four or five inches into the vat, beginning by the long side, which is nearest to him. After the immersion he raises it to a level: by these movements he fetches up on the form a sufficient quantity of stuff; and as soon as the form is raised the water escapes through the wire-cloth, and the superfluity of the stuff over the sides of the frame. The fibrous parts of the stuff arrange themselves regularly on the wire-cloth of the form, not only in proportion as the water escapes, but also as the workman favours this effect by gently shaking the form. Afterwards, having placed the form on a piece of board, the workman takes off the frame or deckle, and glides this form towards the coucher; who, having previously laid his felt, places it with his left hand in an inclined situation, on a plank fixed on the edge of the vat, and full of holes. During this operation the workman applies his frame, and begins a second sheet. The coucher seizes this instant, takes with his left hand the form, now sufficiently dry, and laying the sheet of paper upon the felt, returns the form by gliding it along the trepan of the vat.

They proceed in this manner, laying alternately a sheet and a felt, till they have made six quires of paper, which is called a *post*; and this they do with such swiftness, that, in many sorts of paper, two men make upwards of 20 posts in a day. When the last sheet of the post is covered with the last felt, the workmen about the vat unite together, and submit the whole heap to the action of the press. They begin at first to press it with a middling lever, and afterwards with a lever about fifteen feet in length. After this operation another person separates the sheets of paper from the felts, laying them

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in a heap; and several of these heaps collected together are again put under the press.

16 Grain of paper.

The stuff which forms a sheet of paper is received, as we have already said, on a form made of wire cloth, which is more or less fine in proportion to the stuff, and surrounded with a wooden frame, and supported in the middle by many cross bars of wood. In consequence of this construction, it is easy to perceive, that the sheet of paper will take and preserve the impressions of all the pieces which compose the form, and of the empty spaces between them

The traces of the wire-cloth are evidently perceived on the side of the sheet which was attached to the form, and on the opposite side they form an assemblage of parallel and rounded risings. As in the paper which is most highly finished the regularity of these impressions is still visible, it is evident that all the operations to which it is submitted have chiefly in view to soften these impressions without destroying them.—It is of consequence, therefore, to attend to the combination of labour which operates on these impressions. The coucher, in turning the form on the felt, flattens a little the rounded eminences which are in relievo on one of the surfaces, and occasions at the same time the hollow places made by the wire-cloth to be partly filled up. Meanwhile the effort which is made in detaching the form, produces an infinite number of small hairs on every protuberant part of the sheet.

Under the action of the press, first with the felts and then without them, the perfecting of the grain of paper still goes on. The vestiges of the protuberances made by the wires are altogether flattened, and of consequence the hollows opposite to them disappear also; but the traces formed by the interstices of the wire, in consequence of their thickness, appear on both sides, and are rounded by the press.

The risings traced on each side of the paper, and which can be discovered by the eye on that which is most highly finished, form what is called the *grain of paper*. The different operations ought to soften but not destroy it; which is effectually done by employing the hammer. This grain appears in the Dutch paper; which is a sufficient proof, that though they have brought this part of the art to the greatest perfection, they have not employed hammers, but more simple and ingenious means. The grain of paper is often disfigured by the felts when they are too much used, or when the wool does not cover the thread. In this case, when the paper is submitted to the press, it takes the additional traces of the warp and the woof, and composes a surface extremely irregular.

The paper, the grain of which is highly softened, is much fitter for the purposes of writing than that which is smoothed by the hammer: on the other hand, a coarse and unequal grain very much opposes the movements of the pen; as that which is beat renders them very uncertain. The art of making paper, therefore, should consist in preserving, and at the same time in highly softening, the grain: the Dutch have carried this to the highest perfection.

17 Exchange.

The exchange succeeds the operation last described. It is conducted in a hall contiguous to the vat, supplied with several presses, and with a long table. The workman arranges on this table the paper, newly fabricated, into heaps; each heap containing eight or ten of those last under the press, kept separate by a woollen felt. The press is large enough to receive two of them at once, placed the one at the other's side. When the compression is judged sufficient, the heaps of paper are carried back to the table, and the whole turned sheet by sheet, in such a manner that the surface of every sheet is exposed to a new one; and in this situation they are again brought under the press. It is in conducting these two operations sometimes to four or five times, or as often as the nature of the paper requires, that the perfection of the Dutch plan consists. If the stuff be fine, or the paper slender, the exchange is less frequently repeated. In this operation it is necessary to alter the situation of the heaps, with regard to one another, every time they are put under the press; and also, as the heaps are highest towards the middle, to place small pieces of felt at the extremities, in order to bring every part of them under an equal pressure. A single man with four or five presses may exchange all the paper produced by two vats, provided the previous pressing at the vats be well performed. The work of the exchange generally lasts about two days on a given quantity of paper.

When the paper has undergone these operations, it is not only softened in the surface, but better felted, and rendered more pliant in the interior parts of the stuff. In short, a great part of the water which it had imbibed in the operation of the vat is dissipated. By the felting of paper is understood the approximation of the fibres of the stuff, and their adhering more closely together. The paper is felted in proportion as the water escapes; and this effect is produced by the management and reiterated action of the press. Were it not for the gradual operation of the press, the paper would be porous, and composed of filaments adhering closely together. The superiority of the Dutch over the French paper depends almost entirely on this operation.

If the sheets of paper are found to adhere together, it is a proof that the business of the press has been badly conducted. To avoid this inconveniency, it is necessary to bring down the press at first gently, and by degrees with greater force, and to raise it as suddenly as possible. By this means the water, which is impelled to the sides of the heaps, and which has not yet escaped, returns to the centre; the sheets are equally dry, and the operation executed without difficulty.

According to the state of dryness in which the paper is found when it comes from the apartment of the vat, it is either pressed before or after the first exchange. The operation of the press should be reiterated and managed with great care; otherwise, in the soft state of the paper, there is a danger that its grain and transparency be totally destroyed. Another essential principle to the success of the exchange is, that the grain of the paper be originally well raised. For this purpose the wire cloth of the Dutch forms is composed of a rounder wire than those used in France, by which they gain the greatest degree of transparency, and are in no danger of destroying the grain. Besides this, the Dutch take care to proportion the wires even where the forms are equal to the thickness of the paper.

Almost every kind of paper is considerably improved by the exchange, and receives a degree of perfection which renders it more agreeable in the use. But it is necessary to observe at the same time, that all papers are

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are not equally susceptible of this melioration; on the contrary, if the stuff be unequal, dry, or weakened by the destruction of the fine parts, it acquires nothing of that lustre and softness, and appearance of velvet, which the exchange gives to stuffs properly prepared.

18 Of the drying of paper.

The sheds for drying the paper are in the neighbourhood of the paper mill; and are furnished with a vast number of cords, upon which they hang the sheets both before and after the sizing. The sheds are surrounded with moveable lattices, to admit a quantity of air sufficient for drying the paper. The cords of the shed are stretched as much as possible; and the paper, four or five sheets of it together, is placed on them by means of a wooden instrument resembling a pickaxe. The principal difficulty in drying the paper, consists in gradually admitting the external air, and in preventing the cords from imbibing moisture. With regard to the first of these, the Dutch use very low sheds, and construct their lattices with great exactness. By this means the Dutch paper is dried equally, and is extremely supple before the sizing. They prevent the cords from imbibing the water by covering them with wax. In using such cords, the moisture does not continue in the line of contact between the paper and the cord, which prevents the sheet from stretching in that particular place by its weight, and from the folds which the moisture in the subsequent operations might occasion. The Dutch also employ cords of considerable thickness, and place fewer of them under the sheets; by which means they diminish the points of contact, and give a freer and more equal circulation to the air.

19 Of the sizing of paper.

The size for paper is made of the shreds and pairings got from the tanners, curriers, and parchment makers. All the putrefied parts and the lime are carefully separated from them, and they are enclosed into a kind of basket, and let down by a rope and pulley into the cauldron. This is a late invention, and serves two valuable purposes. It makes it easy to draw out the pieces of leather when the size is extracted from them by boiling, or easy to return them into the boiler if the operation be not complete. When the substance is sufficiently extracted, it is allowed to settle for some time; and it is twice filtered before it is put into the vessel into which they dip the paper.

Immediately before the operation, a certain quantity of alum is added to the size. The workman takes a handful of the sheets, smoothed and rendered as supple as possible, in his left hand, dips them into the vessel, and holds them separate with his right, that they may equally imbibe the size. After holding them above the vessel for a short space of time, he seizes on the other side with his right hand, and again dips them into the vessel. When he has finished ten or a dozen of these handfuls, they are submitted to the action of the press. The superfluous size is carried back to the vessel by means of a small pipe. The vessel in which the paper is sized is made of copper, and furnished with a grate, to give the size when necessary a due temperature; and a piece of thin board or felt is placed between every handful as they are laid on the table of the press.

The Dutch are very careful, in sizing their paper, to have every sheet in the same handful of equal dryness; because it is found that the dry sheets imbibe the size more slowly than those which retain some degree of moisture. They begin by selecting the *padges* in the drying house; and after having made them supple, and having destroyed the adherence between the sheets, they separate them into handfuls in proportion to the dryness, each of them containing that number which they can dip at one time. Besides this precaution, they take care to apply two sheets of brown paper of an equal size to every handful. This brown paper, firm, solid, and already sized, is of use to support the sheets.

As soon as the paper is sized, it is the practice of some paper mills to carry it immediately to the drying house, and hang it, before it cools, sheet by sheet on the cords. The paper, unless particular attention be paid to the lattices of the drying-house, is apt to dry too fast, whereby a great part of the size goes off in evaporation; or, if too slow, it falls to the ground. The Dutch drying-houses are the best to prevent these inconveniencies:—But the exchange after the sizing, which is generally practised in Holland, is the best remedy. They begin this operation on the handfuls of paper, either while they are still hot, or otherwise, as they find it convenient. But, after the exchange, they are careful to allow the heaps to be altogether cold before they are submitted to the press. Without this precaution, the size would either be wholly squeezed out by the press of the exchange, or the surface of the paper become very irregular. It is of consequence that the paper, still warm from the sizing, grow gradually firm under the operation of the exchange, in proportion as it cools. By this method it receives that varnish which is afterwards brought to perfection under the press, and in which the excellency of the paper either for writing or drawing chiefly consists. It is in consequence of the exchanging and pressing that the Dutch paper is soft and equal, and that the size penetrates into the body of it, and is extended equally over its surface.

The exchange after the sizing ought to be conducted with the greatest skill and attention, because the grain of the paper then receives impressions which can never be eradicated. When the sized paper is also exchanged, it is possible to hang more sheets together on the cords of the drying-house. The paper dries better in this condition, and the size is preserved without any sensible waste, because the sheets of paper mutually prevent the rapid operation of the external air. And as the size has already penetrated into the paper, and is fixed on the surface, the insensible progress of a well conducted drying-house renders all the good effects more perfect in proportion as it is slowly dried.

If to these considerations be added the damage done to the paper in drying it immediately after the press of the sizing room, whether it be done in raising the hairs by separating the sheets, or in cracking the surface, it is evident that the trouble of the second exchange is infinitely overpaid by the advantage.

20 Of the finishing room.

When the paper is sufficiently dry, it is carried to the finishing room, where it is pressed, selected, examined, folded, made up into quires, and finally into reams.—It is here put twice under the press; first, when it is at its full size, and secondly, after it is folded.

The principal labour of this place consists in assorting the paper into different lots, according to its quality and faults; after which it is made up into quires. The person who does this must possess great skill, and be capable of great attention, because he acts as a check on those who

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who separated the paper into different lots. He takes the sheets with his right hand, folds them, examines them, lays them over his left arm till he has the number requisite for a quire, brings the sides parallel to one another, and places them in heaps under the table. An expert workman, if proper care has been taken in assorting the lots, will finish in this manner near 600 quires in a day.

The paper is afterwards collected into reams of 20 quires each, and for the last time put under the press, where it is continued for 10 or 12 hours, or as long as the demand of the paper-mill will permit.

21 A new method of bleaching the rags or stuff.

A method has lately been discovered of bleaching the rags or stuff, which will undoubtedly be adopted everywhere in the preparation of writing paper, provided the expence of the process be not too great. This discovery was made by Scheele, M. Berthollet, and M. Chaptal. The first of these illustrious writers communicated to the Swedish Academy of Sciences an Essay on Manganese, containing a numerous series of experiments, intended to investigate the nature and properties of that substance. Among these experiments were several which pointed out a new state of the muriatic acid, or the acid distilled from sea-salt, otherwise known under the name of the *acid* or *spirit of sea-salt*. This state of the muriatic acid was produced by Mr Scheele, in consequence of putting the said acid into a retort or distilling vessel, along with the above-mentioned substance called *manganese*, and distilling over the acid into a proper receiver; it was found to have changed its nature and properties in a very remarkable manner, while at the same time the manganese remaining in the retort had suffered a very material alteration.

To the new state of the acid thus produced, in consequence of certain theoretic ideas which Mr Scheele entertained respecting the mutual action of the original muriatic acid and the manganese on each other during the process of distillation, he gave the name of *dephlogisticated muriatic acid*. Since the time of this original discovery, in consequence of certain changes which have occurred in the theory or philosophy of chemistry, this new state of the acid of sea-salt has been called the *oxygenated muriatic acid*. Among many other properties of it discovered by Mr Scheele, the most remarkable was, that it destroyed the colour of every vegetable substance which was exposed to its action; or, in other words, it bleached them; or, in the language of the dyers, it discharged their colours; that is to say, whatever happened to be the colour of any vegetable body that was submitted to the action of the oxygenated or dephlogisticated muriatic acid, it always became white, or lost its colouring matter.

In the year 1786, Dr Beddoes, then professor of chemistry in the university of Oxford, published an English translation of the Chemical Essays of Mr Scheele; and thereby made known to the chemists of Great Britain the power of the oxygenated or dephlogisticated muriatic acid, to bleach or whiten vegetable substances, or to discharge or decompose their colours. But M. Berthollet, a celebrated chemist in France, and one of the members of the Academy of Sciences at Paris, appears to have been the first who thought of rendering the above-recited discovery subservient to the purposes of manufacture.

In 1789, he published in the *Annales de Chimie* an essay calculated entirely for the use of manufacturers, by being divested of theoretic discussions; of which the title is, "Method of Bleaching Linen or Cotton Cloths, Threads, and Yarns, by means of oxygenated Muriatic Acid, and of some other properties of that Liquor which may be useful in Manufactures."

In the same work, and in the same year, Mr Chaptal, another French chemist, published an account of some experiments, in which, among many other applications of the oxygenated muriatic acid to purposes useful in the economical arts, he gives information of having bleached or whitened coarse rags used by the paper-makers, so as greatly to improve the quality of the paper into which they were afterwards manufactured. His preparation of this bleaching liquor differs not from Berthollet's, which is as follows: "Take six ounces of manganese and sixteen ounces of sea-salt, both reduced to fine powder; mix these accurately, and introduce them into a retort or distilling vessel: Then take twelve ounces of oil of vitriol and eight ounces of water, mixed together, and allowed to cool; add these to the other ingredients in the retort, and connect the retort with a cask or receiver capable of holding twenty-seven gallons and a half of water, but only containing twenty-five gallons, which is to be impregnated with the gas or vapour of the oxygenated muriatic acid; and proceed to distillation, first without and afterwards with a fire gradually raised, till the whole acid comes over."

Experiments have been made with this liquor both by some of the principal paper-makers in the neighbourhood of Edinburgh, and by Messrs Clement and George Taylors of Maidstone in Kent. By the former it was found, that paper made of rags and pulp whitened in this manner, was superior to any other made of similar materials, not only in colour but in fineness of texture. By the latter, the excellence of the liquor was found to be so great, that probably having never heard of Scheele, Berthollet, and Chaptal, and conceiving themselves to be the first inventors of it, they obtained a patent for its exclusive use, which other manufacturers will doubtless disregard. It is not to be concealed, however, that, even with all the precautions which can possibly be taken at first, various circumstances of imperfection must necessarily remain to be removed by means of farther experience, both in the perfection of the bleaching process and the economy of its application to use; but for the attaining of this experience a short time will rarely be sufficient. The above account, it must appear, refers to the time when the bleaching of rags by this process was first introduced. The practice, we find is still (1808) successfully continued by some of the manufacturers in the vicinity of Edinburgh, and has been improved by using the bleaching salt (the hyperoxymuriate of lime), the right to the preparation of which is exclusively vested by patent in Messrs Tennant and Company of Glasgow.

SECT. II. *Of the different Kinds of Paper.*

22 Writing paper.

THE paper proper for writing should be without knots, without any parts of the stuff not triturated, without folds, and without wrinkles, of a supple texture, its grain uniform and regular, softened in the exchange, Different kinds of Paper.

exchange, and not destroyed by smoothing. The ground of this paper must be extremely white, or shaded with a very light blue, which adds to its natural splendour. It is of great importance that it be fully and equally sized, otherwise the writing cannot be well finished, and the turnings of the letters will be very imperfect. This paper should be made from stuff not putrefied, which takes a better grain, receives more benefit from the exchange, is more equally sized, and, finally, is less subject to folds and wrinkles in the different operations. To make paper peculiarly fit for durable writing, Dr Lewis recommends the impregnation of it with astringent materials. "It is observable (says he) that writings first begin to fade or change their colour on the back of the paper, where the larger strokes have sunk in, or are visible through it; as if part of the irony matter of the vitriol was in a more subtile or dissolved state than the rest, and sunk further, on account of its not being fully disengaged from the acid, or sufficiently combined with the astringent matter, of the galls. Hence, it should seem probable, that if the paper was impregnated with astringent matter, the colour of the ink would be more durable. To see how far this notion was well founded, I dipt some paper in an infusion of galls: and, when dry, repeated the dipping a second and third time. On the paper thus prepared, and some that was unprepared, I wrote with different inks; several of which, that the effects might be more sensible, had an over-proportion of vitriol. The writings being exposed to the weather till the best of the inks on the unprepared paper had faded and changed their colour, those on the prepared paper were all found to retain their blackness. It is therefore recommended to the consideration of the paper-makers, whether a particular kind of paper might not be prepared for those uses where the long duration of the writing is of principal importance, by impregnating it with galls or other astringents, in some of the operations it passes through before it receives the glazing; as, for instance, by using an astringent infusion, instead of common water, in the last operation, when the matter is reduced into a pulp for being formed into sheets. The brownish hue which the paper receives from the galling, would not perhaps be any great obstacle to its use; and, if the proposal should be thought worthy of being carried into execution, further inquiries may possibly discover the means of obviating the imperfection, and communicating astringency without colour."

23 For durable writing.

24 Paper fit for drawing, or for coloured maps.

The paper used for drawing, or for coloured maps, is in some mills made from one kind of white stuff, either fine or middling; in others, from a mixture of three or four kinds of stuff of different colours. The Dutch were not long ago almost wholly in possession of this manufacture. The same qualities are necessary in this paper as in that for writing. The grain, however, must be a little more raised, although softened by the exchange; for, without this grain, the pencil would leave with difficulty the traces of the objects. Great care is also necessary in the sizing of this paper, that the drawing be neatly performed, and also that the sinking of the ink or colours into the irregularities of the stuff be prevented.

25 Of furniture paper.

This paper is also made in greatest perfection by stuffs not rotted. These take a more even gloss, and are in better condition to receive all the impressions of the painter. It is also necessary that furniture paper be well softened, and submitted to the exchange, to take more exactly the outlines of the figures. The French have carried this part of the manufacture of paper to the highest state of perfection.

26 Pasteboard used in the manufacture of woollen cloth.

The British and Dutch have had the greatest success in manufacturing pasteboard, which they make either from a single mass of stuff on the form, or from a collection of several sheets pasted together. In both cases, the sheets of pasteboard are made of stuff not rotted, and triturated with rollers furnished with blades of well tempered steel. By the operation of the exchange, and smoothing continued for a long time, the British and Dutch obtain solid and smooth stuffs, which neither break under the folds of cloth, nor adhere to them. The stuffs not putrefied have another advantage in this species of pasteboard, namely, that of resisting the action of heat, which they experience between the folds of cloth, without wasting or tarnishing, and of consequence they may be used for a long time.

27 Printing paper.

In England they have at least equalled any other nation in the manufacture of this paper; and even in Scotland they have arrived to such a degree of perfection in this art, that great part of what they manufacture is sent into England. It requires to be made of a soft and equal stuff, without folds or wrinkles, of a natural whiteness, and with a shade of blue. It must be sized less strongly than writing paper, but sufficiently well to give neatness to the characters. The paper, thus properly prepared, yields easily to the printing press, and takes a sufficient quantity of ink. The stuff must be without grease, and wrought with that degree of slowness, as to make it spread equally over the form, and take a neat and regular grain; without this the characters will not be equally marked in every part of the page; and the smallest quantity of grease renders the sizing unequal and imperfect. Some artists with considerable success, both to meliorate the grain, and to reduce the inequalities of the surface, have submitted this paper to the exchange. And it is proper to add, that a moderate degree of exchanging and of pressing may be of great service after the sheets are printed, to destroy the hollow places occasioned by the press, and the relievo of the letters.

28 Paper for engraving.

Engraving requires a paper of the same qualities with the last mentioned, with respect to the stuff, which must be pure, without knots, and equally reduced; the grain uniform, and the sheets without folds or wrinkles. To preserve the grain, it is necessary that it be dried slowly in the lowest place of the drying-house. If it is submitted to the exchange, the effects of it must be moderated with the greatest care, and the action of the two first presses must be equally distributed over the whole mass, otherwise the inequality of the moisture at the middle and sides will expose it to wrinkles in the drying. The sizing of this paper must also be moderate. These circumstances are necessary to make it receive with neatness all the soft and delicate touches of the plate. —The soft and yielding paper of Auvergne possesses all those advantages; and accordingly a great quantity of this and of printing paper were formerly imported into Britain and Holland from France, where they still continue to rot the materials from which they make engraving

graving paper. The wire-wove frame, though but lately invented, is, we are told, peculiarly adapted to this kind of paper.

29 Paper for cards or any kind of painting on a smooth surface.

Paper for cards must be manufactured from a pretty firm stuff, in order to take that degree of smoothness which makes the cards glide easily over one another in using. For this reason the cardmakers reject every kind of paper which is soft and without strength. This paper requires to be very much sized, since the sizing holds the place of varnish, to which the smoothing gives a glazed and shining surface. To answer all these purposes, the rags require to be a little rotted, and the mallets strongly armed with iron studs. Formerly Angoumois was almost the only province in France which sold card-paper to the Dutch and the other northern nations. The rags of Angoumois have the peculiar quality of not turning too soft in the putrefaction, and the mills of that province reduce them to stuff though they be not much putrefied. The French, we believe, excel every other nation in this branch of the manufacture of paper.

Sect. III. *Miscellaneous Observations on Paper.*

30 To preserve paper from sinking.

To hinder paper from sinking, take about the size of a nut of rock alum, dissolve it in a glass of clear water, and apply it to the paper, which has not been sufficiently sized, with a fine sponge. It is in this manner that the paper-manufacturers of Paris prepare the paper for drawing called *papiers laves*. When there is occasion to write on a printed book, or on paper too fresh, it is sufficient to mix a little gum with ordinary ink.

31 Paper varnished for writing.

To give to writing paper a brilliant varnish, take that which is of an ordinary fineness, very smooth, without any kind of stain or hairs on its surface; stretch it on a smooth plank, and by means of a hare's foot cover it with a thin and equal layer of sandarac finely powdered. Afterwards, if a whole ream is to be varnished, take eight ounces of rock alum and one ounce of white sugarcandy; bring them to boil in six pints of water; and when the liquor is lukewarm, wet that side of the sheet which has been covered with the sandarac with a fine sponge; lay the sheets in a heap, one sheet exactly above another; and submit the ream to the press for the space of twelve hours: hang them afterwards sheet by sheet on the cords of the drying-house; put them again under the press for some days to stretch them; and, finally, beat them with a bookbinder's mallet. This paper can only be used for three or four months after it is prepared.

32 Paper prepared for drawing.

Painters prepare their paper for drawing, and give it a dark ground, which spares them much labour of the pencil afterwards in those places where shade is necessary. For this purpose, they take white paper and pass a sponge over it, which has imbibed water impregnated with soot, leaving the light places to be formed afterwards. They use also a kind of paper for drawing, which is called tainted paper. A light colour is passed over the whole ground, which deprives the paper of its original brightness, and makes the light places of the print appear more in relievo, and more luminous.

33 Paper prepared for copying a print.

The method most common and most convenient for copying a print, is to use oiled paper. The manner of preparing this paper is to take that which is thin and smooth, known commonly by the name of *serpent paper*, and moisten it with a composition, two parts of the oil of walnuts and one part of the oil of turpentine mixed well together. A sheet of pasteboard and a sheet of paper are laid on a smooth table; above them are placed two sheets of paper to be prepared; and a layer of the oil applied to the uppermost is sufficient to penetrate both. This may be done to any number of sheets, and a strong sheet of pasteboard is placed over the whole. The heap is afterwards submitted to the press, under which it remains for two or three days till the oil be completely dry. Paper prepared in this manner serves to copy very readily and exactly all kinds of figures and plans; because, being altogether transparent, all the parts of the drawing, whether of light or shade, are easily distinguished.

34 Incombustible paper.

Besides the paper made from the asbestos, it is necessary for wrapping up gunpowder and valuable writings, to have a paper that will not easily take fire. The manner in which this is prepared is extremely simple. Ordinary paper is dipped into boiling liquid, consisting of three-fourths of water, and one-fourth of dissolved alum. This salt, which is not inflammable, covers the surface of the paper, and renders it in some measure incombustible.

35 A method of erasing ink from paper.

In the season of verjuice, a little of it diluted with water is sufficient for obliterating any fresh spot of ink. The salt of the verjuice dissolved in water answers the purpose equally well, and the salt of sorrel or oxalic acid is also employed with this view. If the spots be dry, and the above acids are insufficient to eradicate them, a little aquafortis diluted in water, and applied with the feather of a quill or a fine hair-pencil, will make them entirely disappear.

36 A method for taking oil stains out of paper.

Books and manuscripts are sometimes defaced by accidental stains with oil. To remove such blemishes, burn sheeps bones and reduce them to a fine powder; lay a quantity of this powder on each side of the stain; place it between two sheets of white paper, and submit it for 12 hours to the press. If the stains have not disappeared, it will be necessary to reiterate the process.

37 A method of making oiled paper take colours.

To make oiled papers take colours; mix with the colours a very small quantity either of the gall of a pike or carp; and, as these substances are of the nature of soap, they dissolve the grease that is in the paper, and permit the colours to be spread over the surface.

38 To make emery paper.

Emery paper, which is employed for taking the rust from iron without wasting it, is made by impregnating coarse paper with gummed water or any other tenacious substance, and then covering it over with the finest emery.

39 Staining or colouring of paper.

The colours proper for paper are not different from those used for other substances, and are enumerated under the article *Colour-Making*. They are applied with soft brushes, after being tempered to a due degree with size or gum-water. If the paper on which they are to be laid is soft, so that the colours are apt to go through, it must also be sized before they are laid on, or a proportionably larger quantity must be used along with the colours themselves. If a considerable extent of the paper is to be done over with one colour, it

Miscellaneous Observations on Paper

it must receive several coatings, as thin as possible, letting each coat dry before another is put on, otherwise the colour will be unequal.

40 To gild paper.

Take yellow ochre, grind it with rain-water, and lay a ground with it upon the paper all over; when dry, take the white of eggs, beat it clear with white sugarcandy, and strike it all over; then lay on the leaf-gold; and when dry, polish it with a tooth. Some take saffron, boil it in water, and dissolve a little gum with it; then they strike it over the paper, lay on the gold: and, when dry, they polish it.

41 To silver paper after the Chinese method without silver.

Take two scruples of clear glue made of neats leather, one scruple of white alum, and half a pint of clear water; simmer the whole over a slow fire, till the water is consumed, or the steam ceases: Then, your sheets of paper being laid on a smooth table, you dip a pretty large pencil into that glue, and daub it over as even as you can, repeating this two or three times: then sift the powder of talc through a fine sieve, made of horse-hair or gauze, over it; and then hang it up to dry; and, when dry, rub off the superfluous talc, which serves again for the same purpose. The talc you prepare in the following manner: Take fine white transparent Muscovy talc; boil it in clear water for four hours; then take it off the fire, and let it stand so for two days: then take it out, wash it well, and put it into a linen rag, and beat it to pieces with a mallet: to 10 pounds of talc add 3 pounds of white alum, and grind them together in a little hand-mill; sift it through a gauze-sieve; and being thus reduced to a powder, put it into water, and just boil it up: then let it sink to the bottom, pour off the water from it, place the powder in the sun to dry, and it will become of a hard consistence. Beat this in a mortar to an impalpable powder, and keep it, for the use above mentioned, free from dust.

42 White and coloured grounds for paper hangings.

The common grounds laid in water are made by mixing whiting with the common glovers size, and laying it on the paper with a proper brush in the most even manner. This is all that is required, where the ground is to be left white; and the paper being then hung on a proper frame till it be dry, is fit to be painted. When coloured grounds are required, the same method must be pursued, and the ground of whiting first laid; except in pale colours, such as straw-colours or pink, where a second coating may sometimes be spared, by mixing some strong colour with the whiting.

43 Method of painting the paper hangings.

There are three methods by which paper-hangings are painted; the first by *printing* on the colours; the second by using the *stencil;* and the third by laying them on with a *pencil*, as in other kinds of painting.

When the colours are laid on by printing, the impression is made by wooden prints; which are cut in such manner, that the figure to be expressed is made to project from the surface by cutting away all the other part; and this, being charged with the colours tempered with their proper vehicle, by letting it gently down on a block on which the colour is previously spread, conveys it from thence to the ground of the paper, on which it is made to fall more forcibly by means of its weight, and the effort of the arm of the person who uses the print. It is easy to conclude, that there must be as many separate prints as there are colours to be printed. But where there are more than one, great care must be taken, after the first, to let the print fall exactly in the same part of the paper as that which went before; otherwise the figure of the design would be brought into irregularity and confusion. In common paper of low price, it is usual, therefore to print only the outlines, and lay on the rest of the colours by stencilling; which both saves the expence of cutting more prints, and can be practised by common workmen, not requiring the great care and dexterity necessary to the using several prints.

The manner of *stencilling* the colours is this. The figure, which all the parts of any particular colour make in the design to be painted, is to be cut out, in a piece of thin leather or oil-cloth, which pieces of leather or oil-cloth are called *stencils;* and being laid flat on the sheets of paper to be printed, spread on a table or floor, are to be rubbed over with the colour, properly tempered, by means of a large brush. The colour passing over the whole is consequently spread on those parts of the paper where the leather or cloth is cut away, and give the same effect as if laid on by a print. This is nevertheless only practicable in parts where there are only detached masses or spots of colours: for where there are small continued lines, or parts that run one into another, it is difficult to preserve the connection or continuity of the parts of the cloth, or to keep the smaller corners close down to the paper: and therefore, in such cases, prints are preferable. Stencilling is indeed a cheaper method of ridding coarse work than printing: but without such extraordinary attention and trouble as render it equally difficult with printing, it is far less beautiful and exact in the effect. For the outlines of the spots of colour want that sharpness and regularity that are given by prints, besides the frequent extralineations, or deviations from the just figure, which happen by the original misplacing of the stencils, or the shifting the place of them during the operation.

Pencilling is only used in the case of nicer work, such as the better imitations of the India paper. It is performed in the same manner as other paintings in water or varnish. It is sometimes used only to fill the outlines already formed by printing, where the price of the colour, or the exactness of the manner in which it is required to be laid on, render the stencilling or printing it less proper; at other times, it is used for forming or delineating some parts of the design, where a spirit of freedom and variety, not to be had in printed outlines, are desired to be had in the work.

44 Management of the flock paper.

The paper designed for receiving the flock is first prepared with a varnish-ground with some proper colour, or by that of the paper itself. It is frequently practised to print some mosaic, or other small running figure in colours, on the ground, before the flock be laid on; and it may be done with any pigment of the colour desired, tempered with varnish, and laid on by a print correspondently to that end.

The method of laying on the flock is this. A wooden print being cut, as is above described, for laying on the colour in such manner that the part of the design which is intended for the flock may project beyond the rest of the surface, the varnish is put on a block covered with the leather or oil-cloth, and the print is to be used also in the same manner, to lay the varnish on all

all the parts where the flock is to be fixed. The sheet, thus prepared by the varnished impression, is then to be removed to another block or table, and to be strewed over with flock; which is afterwards to be gently compressed by a board, or some other flat body, to make the varnish take the better hold of it: and then the sheet is to be hung on a frame till the varnish be perfectly dry; at which time the superfluous part of flock is to be brushed off by a soft camel's-hair brush; and the proper flock will be found to adhere in a very strong manner.

The method of preparing the flock is, by cutting woollen rags or pieces of cloth with the hand, by means of a large bill or chopping knife; or by means of a machine worked by a horse-mill.

There is a kind of counterfeit flock-paper, which, when well managed, has very much the same effect to the eye as the real, though done with less expence. The manner of making this sort is, by laying a ground of varnish on the paper; and having afterwards printed the design of the flock in varnish, in the same manner as for the true; instead of the flock, some pigment, or dry colour, of the same hue with the flock required by the design, but somewhat of a darker shade, being well powdered, is strewed on the printed varnish, and produces nearly the same appearance.

Miscellaneous Observations on Paper.

Paper-Money is a term frequently made use of for bank-bills, which pass currently in trade instead of gold and silver.

Concerning this species of currency, the national utility of which has been controverted by some, we have the following observations in Dr Smith's Treatise on the Wealth of Nations: "The substitution of paper in the room of gold and silver money replaces a very expensive instrument of commerce with one much less costly, and sometimes equally convenient. Circulation comes to be carried on by a new wheel, which it costs less both to erect and maintain than the old one.

"When the people of any particular country have such confidence in the fortune, probity, and prudence of a particular banker, as to believe that he is always ready to pay upon demand such of his promissory notes as are likely at any time to be presented to him, those notes come to have the same currency as gold and silver money, from the confidence that such money can at any time be had for them.

A particular banker lends among his customers his own promissory notes, to the amount, we shall suppose, of 100,000l. As those notes serve all the purpose of money, his debtors pay him the same interest as if he had lent him so much money. This interest is the source of his gain. Though some of those notes are continually coming back upon him for payment, part of them continue to circulate for months and years together. Though he has generally in circulation, therefore, notes to the amount of 100,000l. 20,000l. in gold and silver may frequently be a sufficient provision for answering occasional demands. By this operation, therefore, 20,000l. in gold and silver perform all the functions which 100,000l. could otherwise have performed. Eighty thousand pounds of gold and silver can therefore, in this manner, be spared from the circulation of the country; and if different operations of the same kind should at the same time be carried on by many different banks and bankers, the whole circulation may be thus conducted with a fifth part only of the gold and silver.

"Let us suppose, for example, that the whole circulating money of some particular country amounted, at a particular time, to 1,000,000l. sterling, that sum being then sufficient for circulating the whole annual produce of their land and labour. Let us suppose too, that some time thereafter, different banks and bankers issued promissory notes, payable to the bearer, to the extent of 1,000,000l. reserving in their different coffers 200,000l. for answering occasional demands. There would remain, therefore, in circulation 800,000l. in gold and silver, and 1,000,000l. of bank notes, or 1,800,000l. of paper and money together. But the annual produce of the land and labour of the country had before required only 1,000,000l. to circulate and distribute it to its proper consumers, and that annual produce cannot be immediately augmented by those operations of banking. One million, therefore, will be sufficient to circulate it after them. The goods to be bought and sold being precisely the same as before, the same quantity of money will be sufficient for buying and selling them. The channel of circulation, if I may be allowed such an expression, will remain precisely the same as before. One million we have supposed sufficient to fill that channel. Whatever, therefore, is poured into it beyond this sum, cannot run in it, but must overflow. One million eight hundred thousand pounds are poured into it. Eight hundred thousand pounds, therefore, must overflow, that sum being over and above what can be employed in the circulation of the country. But though this sum cannot be employed at home, it is too valuable to be allowed to lie idle. It will therefore be sent abroad, in order to seek that profitable employment which it cannot find at home. But the paper cannot go abroad; because, at the distance from the banks which issue it, and from the country in which payment of it can be exacted by law, it will not be received in common payments. Gold and silver, therefore, to the amount of 800,000l. will be sent abroad, and the channel of home circulation still remain filled with 1,000,000l. of paper instead of 1,000,000l. of those metals which filled it before.

"But though so great a quantity of gold and silver is thus sent abroad, we must not imagine that it is sent abroad for nothing, or that its proprietors make a present of it to foreign nations. They will exchange it for foreign goods of some kind or another, in order to supply the consumption either of some other foreign country or their own.

"If they employ it in purchasing goods in one foreign country in order to supply the consumption of another,

another, or in what is called the *carrying trade*, whatever profit they make will be an addition to the neat revenue of their own country. It is like a new fund, created for carrying on a new trade; domestic business being now transacted by paper, and the gold and silver being converted into a fund for this new trade.

"If they employ it in purchasing foreign goods for home consumption, they may either first purchase such goods as are likely to be consumed by idle people who produce nothing, such as foreign wines, foreign silks, &c.; or, secondly, they may purchase an additional stock of materials, tools, and provisions, in order to employ an additional number of industrious people, who reproduce, with a profit, the value of their annual consumption.

"So far as it is employed in the first way, it promotes prodigality, increases expence and consumption without increasing production, or establishing any permanent fund for supporting that expence, and is in every respect hurtful to the society.

"So far as it is employed in the second way, it promotes industry; and though it increases the consumption of the society, it provides a permanent fund for supporting that consumption, the people who consume, reproducing, with a profit, the whole value of their annual consumption. The gross revenue of the society, the annual produce of their land and labour, is increased by the whole value which the labour of these workmen adds to the materials upon which they are employed; and their neat revenue by what remains of this value, after deducting what is necessary for supporting the tools and instruments of their trade.

"That the greater part of the gold and silver which, being forced abroad by those operations of banking, is employed in purchasing foreign goods for home consumption, is, and must be employed for purchasing those of this second kind, seems not only probable, but almost unavoidable. Though some particular men may sometimes increase their expence very considerably, though their revenue does not increase at all, we may be assured that no class or order of men ever does so; because, though the principles of common prudence do not always govern the conduct of every individual, they always influence that of the majority of every class or order. But the revenue of idle people, considered as a class or order, cannot in the smallest degree be increased by those operations of banking. Their expence in general, therefore, cannot be much increased by them, though that of a few individuals among them may, and in reality sometimes is. The demand of idle people, therefore, for foreign goods, being the same, or very nearly the same, as before, a very small part of the money, which being forced abroad by those operations of banking, is employed in purchasing foreign goods for home consumption, is likely to be employed in purchasing those for their use. The greater part of it will naturally be destined for the employment of industry, and not for the maintenance of idleness.

"When we compute the quantity of industry which the circulating capital of any society can employ, we must always have regard to those parts of it only which consist in provisions, materials, and finished work: the other, which consists in money, and which serves only to circulate those three, must always be deducted. In order to put industry into motion, three things are requisite; materials to work upon, tools to work with, and the wages or recompense for the sake of which the work is done. Money is neither a material to work upon, nor a tool to work with; and though the wages of the workman are commonly paid to him in money, his real revenue, like that of all other men, consists, not in the money, but in the money's worth; not in the metal pieces, but in what can be got for them.

"The quantity of industry which any capital can employ, must evidently be equal to the number of workmen whom it can supply with materials, tools, and a maintenance suitable to the nature of the work. Money may be requisite for purchasing the materials and tools of the work, as well as the maintenance of the workmen. But the quantity of industry which the whole capital can employ, is certainly not equal both to the money which purchases, and to the materials, tools, and maintenance, which are purchased with it; but only to one or other of those two values, and to the latter more properly than to the former.

"When paper is substituted in the room of gold and silver money, the quantity of the materials, tools, and maintenance, which the whole circulating capital can supply, may be increased by the whole value of gold and silver which used to be employed in purchasing them. The whole value of the great wheel of circulation and distribution is added to the goods which are circulated and distributed by means of it. The operation, in some measure, resembles that of the undertaker of some great work, who, in consequence of some improvement in mechanics, takes down his old machinery, and adds the difference between its price and that of the new to his circulating capital, to the fund from which he furnishes materials and wages to his workmen.

"What the proportion is which the circulating money of any country bears to the whole value of the annual produce circulated by means of it, it is perhaps impossible to determine. It has been computed by different authors at a fifth, at a tenth, at a twentieth, and at a thirtieth part of that value. But how small soever the proportion which the circulating money may bear to the whole value of the annual produce, as but a part, and frequently but a small part, of that produce, is ever destined for the maintenance of industry, it must always bear a very considerable proportion to that part. When, therefore, by the substitution of paper, the gold and silver necessary for circulation is reduced to perhaps a fifth part of the former quantity, if the value of only the greater part of the other four fifths be added to the funds which are destined for the maintenance of industry, it must make a very considerable addition to the quantity of that industry, and consequently to the value of the annual produce of land and labour.

"That part of his capital which a dealer is obliged to keep by him unemployed, for answering occasional demands, is so much dead stock, producing nothing either to him or to his country. The judicious operations of banking enable him to make it active and productive. The gold and silver money which circulates in any country, and by means of which the produce of its land and labour is annually circulated and distributed to the proper consumers, is in the same manner as the ready money of the dealer, all dead stock. It is is a very valuable part of the capital of the country, which produces nothing to the country. The judicious operations of banking, by substituting paper in the room of a great part of it, enables the country to make a great part of this dead stock active and productive. The gold and silver money which circulates in any country, may very properly be compared to a highway, which, while it circulates and carries to market all the grass and corn of the country, produces itself not a single pile of either. The judicious operations of banking, by providing, if I may be allowed so violent a metaphor, a sort of waggon-way through the air, enable the country to convert, as it were, a great part of its highways into good pastures and corn fields, and thereby to increase very considerably the annual produce of its lands and labour. The commerce and industry of the country, however, it must be acknowledged, though they may be somewhat augmented, cannot be altogether so secure, when they are thus, as it were, suspended upon the Dædalian wings of paper money, as when they travel about upon the solid ground of gold and silver.

"The whole paper money of every kind which can easily circulate in any country, never can exceed the value of the gold and silver, of which it supplies the place, or which (the commerce being supposed the same) would circulate there if there was no paper money. If twenty shilling notes, for example, were the lowest paper money current in Scotland, the whole of that currency, which can easily circulate there, cannot exceed the sum of gold and silver which would be necessary for transacting the annual exchanges of twenty shillings value and upwards, usually transacted within that country. Should the circulating paper at any time exceed that sum, as the excess could neither be sent abroad, nor be employed in the circulation of the country, it must immediately return upon the banks to be exchanged for gold and silver. Many people would immediately perceive that they had more of this paper than was necessary for transacting their business at home, and as they could not send it abroad, they would immediately demand payment of it from the banks. When this superfluous paper was converted into gold and silver, they could easily find a use for it by sending it abroad; but they could find none while it remained in the shape of paper. There would immediately, therefore, be a run upon the banks to the whole extent of this superfluous paper, and, if they showed any difficulty or backwardness in payment, to a much greater extent; the alarm which this would occasion necessarily increasing the run." See Banking and Exchange, Supplement.

Paper Office, an office in the palace of Whitehall, in which all the public writings, matters of state and council, proclamations, letters, intelligences, negociations abroad, and generally all despatches that pass through the offices of the secretaries of state, are lodged, by way of library.

PAPIER MACHE. This is a substance made of cuttings of white or brown paper, boiled in water, and beaten in a mortar, till they are reduced to a kind of paste, and then boiled with a solution of gum arabic or of size, to give tenacity to the paste, which is afterwards formed into different toys, &c. by pressing it into oiled moulds. When dry, it is done over with a mixture of size and lamp black, and afterwards varnished. The black varnish for these toys, according to Dr Lewis, is prepared as follows: some colophony, or turpentine boiled down till it becomes black and friable, is melted in a glazed earthen vessel, and thrice as much amber in fine powder sprinkled in by degrees, with the addition of a little spirit or oil of turpentine now and then: when the amber is melted, sprinkle in the same quantity of sarcocolla, continuing to stir them, and to add more spirit of turpentine, till the whole becomes fluid; then strain out the clear through a coarse hair bag, pressing it gently between hot boards. This varnish, mixed with ivory black in fine powder, is applied, in a hot room, on the dried paper paste; which is then set in a gently heated oven, next day in a hotter oven, and the third day in a very hot one, and let stand each time till the oven grows cold. The paste thus varnished is hard, durable, glossy, and bears liquor hot or cold.

PAPHLAGONIA, in *Ancient Geography*, a country of the Hither Asia, beginning at Parthenius, a river of Bithynia, on the west, and extending in length to the Halys eastward, with the Euxine to the north, and Galatia to the south. Pliny enlarges the limits on the west side to the river Billis, on this side the Parthenius. It is called *Pylæmenia* by some (Pliny). *Paphlagones*, the people, mentioned by Homer, and therefore of no small antiquity. A superstitious and silly people (Lucian); a brave people (Homer); taking their name from Phaleg (Bocchart).

PAPHOS, in *Ancient Geography*, two adjoining islands on the west side of the island of Cyprus; the one called *Hallæ Paphos* (Strabo, Ptolemy, Pliny); the other *Nea Paphos;* and when mentioned without an adjunct, this latter is always understood. Both dedicated to Venus, and left undistinguished by the poets (Virgil, Horace). Hence Venus is surnamed *Paphia*. *Paphii*, the people, (Coins, Stephanus). It was restored by Augustus, after a shock of an earthquake, and called *Augusta* (Dio).

The abbé Mariti, in his Travels through Cyprus, gives the following account of the island of Paphos. "It is situated (says he) on the southern side: it contained the celebrated temple of Venus; which, together with the city, was destroyed by an earthquake, so that the least vestige of it is not now to be seen. A lake in the neighbourhood, which even in summer overflows with stagnant and corrupted water, renders the air in some degree unwholesome. On the western coast is the new Paphos, called by some of the modern geographers *Baffos;* a name which is unknown in the island of Cyprus. That we may not positively ascribe to the latter every thing that history tells us of Paphos in general, it may not be here improper to mention that it has been several times destroyed. This city had a port, where vessels trading upon that coast still cast anchor: but this happens only in summer; for, being exposed to every wind, it is extremely dangerous. The bottom of it is full of sharp rocks; which sometimes destroy the cables so much, that mariners are obliged to keep them afloat on the surface of the water, by means of empty casks fixed to them at certain distances. In the neighbourhood there are two castles; one on the borders of the sea, and the other on the summit of a little hill: but the latter is at present in ruins. The government of Paphos consists of a digdaban or commissary; a cadi; and an aga, who presides over the customhouse. Of all the Christian edifices,

edifices, there is none remaining but the church of St George, in which service is performed by the Greek ministers. The productions of this part of the island, which are all of an excellent quality, are silk, barley, and other kinds of grain. To discover the origin of the Old and New Paphos, would be carrying light into the midst of the thickest darkness. When we have added conjecture to conjecture, we are still in the same situation. As this is an attempt superior to my abilities, I shall leave it to the divining, though uncertain, knowledge of our antiquaries. I must, however, observe, that there was here formerly a temple dedicated to Venus, which was entirely destroyed by an earthquake. In this island St Paul by his eloquence converted Sergius, a Roman proconsul. He here likewise conferred the deaconship on his disciple and colleague Titus, who soon after suffered martyrdom. Paphos was an episcopal city in the time of the Lusignans; and it is still the seat of a bishop, who is a suffragan to the archbishop of Nicosia. On the western side of the island there are a great number of scattered villages; but they are not worthy of notice, being either abandoned or in ruins."

Mr Bruce informs us, that in the neighbourhood of this place many silver medals of excellent workmanship are dug up; they are, however, but of little estimation among the antiquarians, being chiefly of towns, of the size of those found at Crete and Rhodes, and in all the islands of the Archipelago. There are some excellent Greek intaglios; generally upon better stones than usual in the islands. This illustrious traveller informs us, that he has seen some heads of Jupiter, remarkable for bushy hair and a beard, which were of excellent workmanship, and worthy of any price. All the inhabitants of the island are subject to fevers, but especially those in the neighbourhood of Paphos. The same traveller observes, that Cyprus was very long undiscovered; for though ships had been sailing on the Mediterranean 1700 years before Christ, and though the island is only a day's sailing from the continent of Asia on the north and east, and little more from that of Africa on the south, it was not known at the building of Tyre, a little before the Trojan war, that is, 500 years after the neighbouring seas had been navigated. It was covered with wood at its first discovery; and our author is of opinion, that it was not well known even at the time of building of Solomon's temple; because we do not find that Hiram king of Tyre, though just in its neighbourhood, ever had recourse to it for wood: though the carriage would undoubtedly have been easier from thence, than to have brought it down from the top of Mount Lebanon. Eratosthenes informs us, that in ancient times the island was so overgrown with wood, that it could not be tilled; so that they first cut down the timber to be used in the furnaces for melting silver and copper; that after this they built fleets with it: but finding even this insufficient, they gave liberty to all strangers to cut it down for whatever purpose they pleased; and not only so, but they gave them afterwards the property of the ground they had cleared. Matters are now quite altered; and the want of wood is a principal complaint in most parts of the island. About Acamas, however, on the west side of the island, the wood is still thick and impervious, inhabited by large stags and wild boars of a monstrous size. Mr Bruce was informed, that a live elephant had lately been seen there, but gave no credit to the account.

PAPIAS, bishop of Hieropolis, a city of Phrygia, was the disciple of St John the Evangelist, and the companion of Polycarp, as St Jerome observes, and not of John the Ancient, as some other authors have maintained. He composed a work in five books, entitled *Expositions of the Discourses of our Lord*, of which there are only some fragments now remaining. He it was who introduced the opinion of the Millenarians.

PAPILIO, the BUTTERFLY, a genus of insects belonging to the order of lepidoptera. See ENTOMOLOGY *Index*.

PAPILIONACEOUS, among *Botanists*, an appellation given to the flowers of plants belonging to various classes, from their resembling the wings of a butterfly.

PAPINIAN, a celebrated Roman lawyer of the third century, under the emperor Severus; who had so high an opinion of his worth, that he recommended his sons Caracalla and Geta to his care. Caracalla having first murdered his brother, ordered Papinian to compose a discourse to excuse this murder to the senate and people; which when he refused to undertake, the brutal emperor ordered him to be beheaded; and his body was dragged through the streets of Rome. Papinian wrote several treatises in the line of his profession.

PAPISTS, are those who believe the pope or bishop of Rome to be the supreme pastor of the universal church, who profess to believe all the articles of Pope Pius's creed, and who promise implicit obedience to the edicts of the church, especially the decrees of the council of Trent. See POPE and TRENT.

PAPPENHEIM, a town of Germany, in the kingkom of Bavaria, and capital of a county of the same name, with a castle, where the counts reside. It is seated near the river Altmal, 17 miles north-west of Neuburg, and 32 south of Nuremburg; and is subject to its own count. E. Long. 10. 51. N. Lat. 48. 58. The count of Pappenheim was hereditary marshal of the empire, and performed his office at the coronation of the emperor.

PAPPUS, an eminent philosopher of Alexandria, said by Suidas to have flourished under the emperor Theodosius the Great, who reigned from A. D. 379 to 395. His writings show him to have been a consummate mathematican: Many of them are lost; the rest continued long in manuscript, detached parts having only been occasionally published in the last century, until Carolus Manolessius published his remains entire at Bologna, in 1660, in folio.

PAPPUS, in *Botany*, a soft downy substance that grows on the seeds of certain plants, as thistles, hawkweed, &c. serving to scatter and buoy them up in the air.

PAPYRUS, the famous reed from which was made the far-famed paper of Egypt. Before entering on the description of the papyrus, it is natural to say a word or two on the opinion generally received in Europe concerning the loss of this plant. Supposing this loss possible, the date of it must be fixed at no distant period; for it is not 200 years since Guilandin and Prosper Alpin observed the papyrus on the banks of

Papyrus,

the Nile. Guilandin saw the inhabitants of the country eating the inferior and succulent part of the stem in the manner of the ancients; a fact which alone shows it to be the papyrus, and of which other travellers seem not to have availed themselves. This practice, together with those related by Prosper Alpin, are sufficient to convince us, that this plant is not wholly useless, although it is not now employed in the fabrication of paper. The alteration on the soil of Egypt, and on the methods of agriculture, have in all probability rendered this plant less common; but causes altogether local could not occasion the destruction of the papyrus, especially as its residence in the marshes would prevent their operation. But it is needless to reason from probabilities or analogy: Mr Bruce not only saw the papyrus growing both in Egypt and Abyssinia, but actually made paper of it in the manner in which it was made by the ancients. He tells us likewise, that, so far from any part of it being useless, the whole plant is at this day used in Abyssinia for making boats, a piece of the acacia tree being put in the bottom to serve as a keel. That such were the boats of ancient Egypt, we know from the testimony of Pliny, who informs us, that the plants were first sewed together, and then gathered up at stem and stern, and tied fast to the keel: "Conseritur bibula Memphitis cymba papyro."

Appendix to Bruce's Travels.

"The bottom, root, or woody part of this plant was likewise of several uses before it turned absolutely hard; it was chewed in the manner of liquorice, having a considerable quantity of sweet juice in it. This we learn from Dioscorides; it was, I suppose, chewed, and the sweetness sucked out in the same manner as is done with sugar cane. This is still practised in Abyssinia, where they likewise chew the root of the Indian corn, and of every kind of cyperus: and Herodotus tells us, that about a cubit of the lower part of the stalk was cut off, and roasted over the fire, and eaten.

"From the scarcity of wood, which was very great in Egypt, this lower part was likewise used in making cups, moulds, and other necessary utensils: we need not doubt, too, one use of the woody part of this plant was, to serve for what we call *boards* or *covers* for binding the leaves which were made of the bark; we know that this was anciently one use of it, both from Alcæus and Anacreon."

The papyrus, says Pliny, grows in the marshes of Egypt, or in the stagnant places of the Nile, made by the flowing of that river, provided they are not beyond the depth of two cubits. Its roots are tortuous, and in thickness about four or five inches: its stem is triangular, rising to the height of ten cubits. Prosper Alpin gives it about six or seven cubits above the water; the stem tapers from the bottom, and terminates in a point. Theophrastus adds, that the papyrus carries a top or plume of small hairs, which is the thyrsus of Pliny. Guilandin informs us, that its roots throw to the right and left a great number of small fibres, which support the plant against the violence of the wind, and against the waters of the Nile. According to him, the leaves of the plant are obtuse, and like the typha of the marshes. Mr Bruce, on the other hand, assures us, that it never could have existed in the Nile. "Its head (says he) is too heavy; and in a plain country the wind must have had too violent a hold of it. The stalk is small and feeble, and withal too tall; the root too short and slender to stay it against the violent pressure of the wind and current; therefore I do constantly believe it never could be a plant growing in the river Nile itself, or in any very deep or rapid river;" but in the calishes or places where the Nile had overflowed and was stagnant.

Papyrus.

The Egyptians made of this plant paper fit for writing (see PAPER), which they call βιϐλος or *philuria*, and also χαρτης, and hence the Latin *charta;* for in general the word *charta* is used for the paper of Egypt.

The papyrus was produced in so great quantities on the banks of the Nile, that Cassiodorus (lib. xi. 30.) compares it to a forest. There, says he, rises to the view, this forest without branches, this thicket without leaves, this harvest of the waters, this ornament of the marshes. Prosper Alpin is the first who gives us a plate of the papyrus, which the Egyptians call *berdi.* This corresponds in some degree with the description of the plant mentioned by Theophrastus; but the best drawing of it has been given by Mr Bruce.

The ancient botanists placed the papyrus among the graminous plants or dog grass; ignorant of the particular kind to which it belonged, they were contented to specify it under the name of *papyrus*, of which there were two kinds, that of Egypt, and that of Sicily. The moderns have endeavoured to show, that these two plants are one and the same species of cyperus. It is under this genus that they are found in the catalogues and descriptions of plants published since the edition of Morrison's work, where the papyrus is called *cyperus niloticus Syriacus maximus papyraceus.*

In the manuscripts of the letters and observations of M. Lippi physician at Paris, who accompanied the envoy of Louis XIV. to the emperor of Abyssinia, we find the description of a cyperus which he had observed on the banks of the Nile in 1704. After having described the flowers, he says that many ears covered with young leaves are supported by a pretty long pedicle; and that many of those pedicles, equally loaded and coming from one joint, form a kind of parasol. The disk of this parasol is surrounded with a quantity of leaves which form a crown to the stem which supports it. The stem is a pretty long prism, the corners of which are a little rounded; and the leaves, not at the top, but at the side, are formed like the blade of a sword; the roots are black and full of fibres; and this plant is called *cyperus Niliacus major, umbella multiplici.*

The same Lippi describes another kind which rises not so high; the stem and leaves correspond with the former, but the ears form rather a kind of head than any thing like the spreading of an umbrella; this head was very soft, shining, and gilded, rich and airy, much loaded, supported by pedicles which were joined together at the bottom like the knitting of a parasol. It is called by him *cyperus Niliacus major aurea, divisa panicula.* These two kinds of cyperus have a marked resemblance in their leaves, their stem, their foliage, and the marshy places where they grow. The only difference consists in their size, and in the position of the ears, which serve to distinguish them; and they seem to bear a resemblance to the papyrus and the sari, described

described by ancient authors. The first is perhaps the papyrus, and the second the sari; but this is only conjecture.

The papyrus, which grew in the waters, is said to have produced no seed; but this Mr Bruce very properly calls an absurdity. "The form of the flower (says he) sufficiently indicates, that it was made to resolve itself into the covering of one, which is certainly very small, and by its exalted situation and thickness of the head of the flower, seems to have needed the extraordinary covering it has had to protect it from the violent hold the wind must have had upon it. For the same reason, the bottom of the filaments composing the head are sheathed in four concave leaves, which keep them close together, and prevent injury from the wind getting in between them." Its plume was composed of slender pedicles, very long, and somewhat like hair, according to Theophrastus. The same peculiarity exists in the papyrus of Sicily; and the same is found to exist in another kind of papyrus sent from Madagascar by M. Poivre, correspondent of the Academy of Sciences.

It is impossible to determine whether the papyrus of Sicily was used in any way by the Romans. In Italy it is called *papero*, and, according to Cesalpin, *pipero*. This papyrus of Sicily has been cultivated in the garden of Pisa; and if we can depend on the authority of Cesalpin, who himself examined the plant, it is different from the papyrus of Egypt.

The papyrus, says he, which is commonly called *pipero* in Sicily, has a longer and thicker stem than the plant cyperus. It rises sometimes to four cubits; the angles are obtuse, and the stem at the base is surrounded with leaves growing from the root; there are no leaves on the stem even when the plant is at the greatest perfection, but it carries at the top a large plume which resembles a great tuft of dishevelled hairs; this is composed of a great number of triangular pedicles, in the form of reeds; at the extremity of which are placed the flowers, between two small leaves of a reddish colour like the cyperus. The roots are woody, about the thickness of reeds, jointed, and they throw out a great number of branches which extend themselves in an oblique direction. These are scented somewhat like the cyperus, but their colour is a lighter brown; from the lower part issue many small fibres, and from the higher a number of stems shoot up, which in proportion as they are tender contain a sweet juice.

The plume of the papyrus of Sicily is pretty well described in a short account of it in the second part of the *Musæum de Boccone*. This plume is a tuft or assemblage of a great number of long slender pedicles, which grow from the same point of division, are disposed in the manner of a parasol, and which carry at the top three long and narrow leaves, from which issue other pedicles, shorter than the former, and terminating in several knots of flowers. Micheli, in his *Nova Plantarum Genera*, printed at Florence 1728, has given an engraving of one of the long pedicles in its natural length: it is surrounded at the base with a case of about one inch and a half in height; towards the extremity it carries three long and narrow leaves, and four pedicles, to which are fixed the knots of flowers. Every pedicle has also a small case surrounding its base. In short, we find in the *Grosto Graphia* of Scheuchzer a very particular description of the plume of a kind of cyperus, which appears to be a Sicilian plant. From this account it appears that the papyrus of Sicily is well known to botanists. It were to be wished that we had as particular a description of the papyrus of Egypt; but meanwhile it may be observed, that these two plants have a near affinity to one another; they are confounded together by many authors; and, according to Theophrastus, the *sari* and the *papyrus nilotica* have a decided character of resemblance, and only differ in this, that the papyrus sends forth thick and tall stems, which being divided into slender plates, are fit for the fabrication of paper; whereas the sari has small stems, considerably shorter, and altogether useless for any kind of paper.

The papyrus, which served anciently to make paper, must not be confounded with the papyrus of Sicily, found also in Calabria; for, according to Strabo, the papyrus was to be found in no place excepting Egypt and India. The greatest part of botanists have believed that the Sicilian plant is the same with the sari of Theophrastus; others have advanced that the papyrus of Egypt and the sari were the same plant in two different stages of its existence, or considered with respect to the greater or less height, which, according to them, might depend on the qualities of the soil, the difference of the climate, or other accidental causes. In proof of this, it is maintained, that there is an essential difference between the papyrus growing in the waters and the same plant growing on the banks of rivers and in marshes. The first of these has thick and tall stems, and a plume in the form of a tuft of hair very long and slender, and without any seed: the second differs from the first in all these particulars; it has a shorter and more slender stem, its plume is loaded with flowers, and of consequence it produces seed. In whatever way we consider these facts, it is sufficient for us to know, that the difference between the papyrus and the sari neither depends on climate, nor soil, nor on situation. The plants whose difference depended on these circumstances, both grew in Egypt, and were both employed in the manufacture of paper. But it is an established fact, that the sari cannot be employed for this purpose.

Finally, The papyrus of Sicily began to be known by botanists in 1570, 1572, 1583, at which periods the works of Lobel, of Guilandin, and of Cesalpin, first appeared. The ancients had no manner of knowledge of this plant. Pliny makes no mention of it in his Natural History; from which it is evident that it was neither used in Rome nor in Sicily. If he had seen this plant, he must have been struck with its resemblance to the papyrus and the sari, as they were described by Theophrastus; and since he gives a particular description of these last mentioned, he would have most naturally hinted at their conformity to the Sicilian papyrus.

Among many dried plants collected in the East Indies by M. Poivre, there is a kind of papyrus very different from that of Sicily. It carries a plume composed of a considerable tuft of pedicles, very long, weak, slender, and delicate, like single threads, terminating most frequently in two or three small narrow leaves, without any knot of flowers between them; hence this plume must be altogether barren. Those pedicles or threads are furnished with a pretty long membranous case, in which

which they are inserted; and they issue from the same point of direction, in the manner of a parasol. The plume, at its first appearance, is surrounded with leaves like the radii of a crown. The stem which supports it is, according to M. Poivre, about ten feet in height, where there is two feet under water; it is of a triangular form, but the angles are rounded; its thickness is about the size of a walking staff which fills the hand.

The interior substance, although soft and full of fibres, is solid, and of a white colour. By this means the stem possesses a certain degree of strength, and is capable of resistance. It bends without breaking; and as it is extremely light, it serves in some sort for a cane: The same M. Poivre used no other during a residence of several months at Madagascar. This stem is not of equal thickness in its whole length; it tapers insensibly from the thickest part towards the top. It is without knots, and extremely smooth. When this plant grows out of the waters, in places simply moist, it is much smaller, the stems are lower, and the plume is composed of shorter pedicles or threads, terminating at the top in three narrow leaves, a little longer than those at the plume when the plant grows in the water. From the base of these leaves issue small knots of flowers, arranged as they are in the cyperus; but these knots are not elevated above the pedicles, they occupy the centre of the three leaves, between which they are placed, and form themselves into a small head. The leaves which spring from the root and the lower part of the stem resemble exactly those in the cyperus. This plant, which the inhabitants call *sanga-sanga*, grows in great abundance in their rivers and on their banks, but particularly in the river Tartas, near the Foule-point in Madagascar. The inhabitants of these cantons use the bark of this plant for mats; they make it also into sails, into cordage for their fishing houses, and into cords for their nets.

This kind of papyrus, so lately discovered, and different from the papyrus of Sicily by the disposition of its flowers, shows, that there are two kinds of the cyperus which might easily be confounded with the papyrus of Egypt; whether we consider, on the one hand, to what purposes the inhabitants of the places where they grow have made them subservient; or, on the other compare their form, their manner of growth, and the points in which they resemble each other. This comparison can be easily made from the accounts which Pliny and Theophrastus gave of the papyrus of Egypt, and by the figure and description given by Prosper Alpin, after having observed the plant on the banks of the Nile. But if we can depend on the testimony of Strabo, who affirms that the papyrus is found nowhere but in Egypt and in India, it is perhaps possible that the papyrus of the isle of Madagascar is the same with that of Egypt.

Whatever truth may be in this conjecture, the inhabitants of this island have never derived from it those advantages which have immortalized the papyrus of Egypt. They have not made that celebrated paper, *quo usu maxime humanitas, vita, constat et memoria.* Mr Russel, a recent traveller (1817), mentions, that a nobleman at Syracuse had succeeded in making paper of the Sicilian papyrus by a process similar to that described by Pliny.

PAR, in *Commerce*, signifies any two things equal in value. See EXCHANGE.

PARABLE, a fable or allegorical instruction, founded on something real or apparent in nature or history, from which a moral is drawn by comparing it with something in which the people are more immediately concerned; such are the parables of Dives and Lazarus, of the Prodigal Son, of the Ten Virgins, &c. Dr Blair observes, that "of parables, which form a part of allegory, the prophetical writings are full; and if to us they sometimes appear obscure, we must remember, that in those early times it was universally the mode throughout all the eastern nations to convey sacred truths under mysterious figure and representations."

PARABOLA. See *CONIC SECTIONS*.

PARABOLE. See ORATORY, N° 84.

PARACELSUS, AURELIUS PHILIP THEOPHRASTUS BOMBASTUS DE HOHENHEIM, a famous physician, born at Einfidlen, a town in the canton of Schweitz in Swisserland. He was educated with great care by his father, who was the natural son of a prince, and in a little time made a great progress in the study of physic. He afterwards travelled into France, Spain, Italy, and Germany, in order to become acquainted with the most celebrated physicians. At his return to Swisserland, he stopped at Basil, where he read lectures on physic in the German tongue. He was one of the first who made use of chemical remedies with success, by which he acquired a very great reputation. Paracelsus gloried in destroying the method established by Galen, which he believed to be very uncertain; and by this means drew upon himself the hatred of the other physicians. It is said, that he boasted of being able, by his remedies, to preserve the life of man for several ages: but he himself experienced the vanity of his promises, by his dying at Saltzburg, in 1505, at 37 years of age according to some, and at 48 according to others. The best edition of his works is that of Geneva in 1658, in 3 vols. folio.

PARACENTESIS, an operation in surgery, commonly called *tapping*. See SURGERY.

PARACLET, the COMFORTER, a name given to the Holy Ghost.

PARADE, in a military sense, the place where troops assemble or draw together, to mount guard, or for any other purpose.

PARADE, in fencing, implies the action of parrying or turning off any thrust.

PARADISE, a term principally used for the garden of Eden, in which Adam and Eve were placed immediately upon their creation.

As to this terrestrial paradise, there have been many inquiries about its situation. It has been placed in the third heaven, in the orb of the moon, in the moon itself, in the middle region of the air, above the earth, under the earth, in the place possessed by the Caspian sea, and under the arctic pole. The learned Huetius places it upon the river that is produced by the conjunction of the Tigris and Euphrates, now called the *river of the Arabs*, between this conjunction and the division made by the same river before it falls into the Persian sea. Other geographers have placed it in Armenia, between the sources of the Tigris, the Euphrates, the Araxes, and the Phasis, which they suppose to be the four rivers described

Paradise.

described by Moses. But concerning the exact place we must necessarily be very uncertain, if indeed it can be thought at all to exist at present, considering the many changes which have taken place on the surface of the earth since the creation.

"Learned men (says Mr Miln*) have laboured to find out the situation of Paradise, which seems to be but a vague and uncertain inquiry; for the Mosaic description of it will not suit any place on the present globe. He mentions two rivers in its vicinity, viz. Pison and Gihon, of which no vestiges can now be found. The other two still remain, viz. the Hiddekel, supposed to be the Tigris, and the Euphrates, whose streams unite together at a considerable distance above the Persian gulf; in some part of which, it is highly probable the happy garden once lay (A). This gulf is eastward both of the land of Midian and the wilderness of Sinai; in one of which places Moses wrote his history. But since the formation of this earth, it has undergone great changes from earthquakes, inundations, and many other causes. The garden, however, seems to have been a peninsula, for the way or entrance into it is afterwards mentioned. We are told that a 'river went out of it;' which, according to some, should be rendered 'run on the outside of it,' and thus gave it the form of a horseshoe: for had the Euphrates run through the middle of the garden, one half of it would have been useless to Adam, without a bridge or boat wherewith to have crossed it."

* *Physico-Theol. Lectures.*

The learned authors of the Universal History, in their account of rarities natural and artificial in Syria, mention "a spot which is still shown as the place where once stood the garden of Eden, or Terrestrial Paradise. And indeed it is in all respects so beautiful and rich, and yields so delightful a prospect from the adjacent hills, that there is hardly another place in the world that has a fairer title to the name it bears. Its proximity to Damascus, the capital of Syria, near the fountain head of the Jordan; its situation between the Tigris or Hiddekel, the Euphrates, the Phasis or Pison, the Araxes or Gihon (which last has those names from its vast rapidity above all other known rivers), its bordering upon the land of Chus, famed for its fine gold; all these and many other marks specified by Moses, together with its charming and surprising fruitfulness, and constant verdure, have induced a great number of commentators to settle that celebrated and so much sought-after spot here, and to deem it the most valuable of all the natural rarities of this country.

Christians, we presume, need not be told, that however curious or amusing this inquiry may be, the determination of it is of no importance, since we are all well assured that the celestial paradise is that place of pure and refined delight in which the souls of the blessed enjoy everlasting happiness.

It may not be improper, however, in this place to give a description of the paradise of the Mohammedans. The sensuality and absurdity of that impostor must be apparent to all men. Their religion has no consistency in its parts, and the descriptions of the future enjoyments of the faithful are miserable instances of human weakness and folly.

"The paradise of the Mohammedans is said by them to be situated above the seven heavens, or in the seventh, and next under the throne of God; and to express the amenity of the place, they tell us that the earth of it is of the finest wheat flour, or of the purest musk, or of saffron; and that its stones are pearls and jacinths, the walls of its buildings enriched with gold and silver, and the trunks of all its trees of gold, amongst which the most remarkable is the tree *tuba*, or tree of happiness. They pretend that this tree stands in the palace of Mohammed, though a branch of it will reach to the house of every true believer, loaded with pomegranates, dates, grapes, and other fruits of surprising bigness, and delicious tastes, unknown to mortals. If a man desires to eat of any particular kind of fruit, it will immediately be presented to him; or if he chooses flesh, birds ready dressed will be set before him, and such as he may wish for. They add, that this tree will supply the blessed not only with fruit, but with silk garments also, and beasts to ride on, adorned with rich trappings, all which will burst forth from the fruit; and that the tree is so large, that a person mounted on the fleetest horse would not be able to gallop from one end of its shade to the other in 100 years. Plenty of water being one of the greatest additions to the pleasantness of any place, the Alcoran often speaks of the rivers of paradise as the principal ornament. Some of these rivers are said to flow with water, some with milk, some with wine, and others with honey: all of them have their sources in the root of this tree of happiness; and, as if these rivers were not sufficient, we are told that the garden of this paradise is also watered by a great number of lesser springs and fountains, whose pebbles are rubies and emeralds, their earth of camphor, their beds of musk, and their sides of saffron. But all these glories will be eclipsed by the resplendent and exquisite beauty of the girls of paradise, the enjoyment of whose company will constitute the principal felicity of the faithful. These (they say) are not formed of clay, as mortal women, but of pure musk; and are, as their prophet often affirms, in his Alcoran, free from all the natural defects and inconveniences incident to the sex. Being also of the strictest

(A) "*God* (we are told) *placed at the east of the garden of Eden cherubims and a flaming sword, which turned every way, to keep the way of the tree of life.* In Scripture, the extraordinary judgments of God are said to be executed by his angels, who are sometimes compared to flames of fire. Therefore the cherubim and the flaming sword may probably mean nothing more than that a large portion of ground on the eastward of Paradise was set on fire during the above awful occasion, and continued burning with such violence, that the flame thereof at a distance appeared like a brandished sword, turning every way with the wind. Now if the soil of Eden was bituminous, like that of Gomorrah (which was once so fertile as to be compared to the "garden of the Lord"), the fire would continue burning till it produced the same effect in the one place as it did in the other, and turned a great part of that tract into sea: which seems to countenance the opinion of those who place the situation of Paradise in some part of the Persian gulf."

strictest modesty, they keep themselves secluded from public view in pavilions of hollow pearls, so large, that as some traditions have it, one of them will be no less than 16, or, as others say, 60 miles long, and as many broad. With these the inhabitants of paradise may taste pleasures in their height; and for this purpose will be endowed with extraordinary abilities, and enjoy a perpetual youth."

Paradise Lost, the name of a modern epic poem, the first and finest of those composed by Milton.

The subject of this poem is extraordinary; it had never before been attempted, and seemed to be above the efforts of human genius. Angels and devils are not the machinery, but the principal actors in it; so that what would appear marvellous in any other composition, is in this only the natural course of events.—The poet's intention was, as he expresses it himself, to vindicate the ways of God to men. How far Milton was happy in the choice of his subject, may be questioned. It has led him into difficult ground, though it certainly suited the daring sublimity of his genius. It is a subject for which he alone was fitted; and, in the conduct of it, he has shown a stretch both of imagination and invention which is perfectly wonderful.

Bird of Paradise. See the following article.

PARADISEA, a genus of birds belonging to the order of picæ. See Ornithology *Index*.

PARADOX, παραδοξον, in philosophy, a proposition seemingly absurd, as being contrary to some received opinions, but yet true in fact.

The vulgar and illiterate take almost every thing, even the most important, upon the authority of others, without ever examining it themselves. Although this implicit confidence is seldom attended with any bad consequences in the common affairs of life, it has nevertheless, in other things, been much abused; and in political and religious matters has produced fatal effects. On the other hand, knowing that learned men, to avoid this weakness have fallen into the contrary extreme: some of them believe every thing to be unreasonable or impossible, that appears so to their first apprehension; not adverting to the narrow limits of the human understanding, and the infinite variety of objects, with their mutual operations, combinations, and affections, that may be presented to it.

It must be owned, that credulity has done much more mischief in the world than incredulity has done, or ever will do; because the influences of the latter extend only to such as have some share of literature, or affect the reputation thereof. And since the human mind is not necessarily impelled, without evidence, either to belief or unbelief, but may suspend its assent to, or dissent from, any proposition, till after a thorough examination; it is to be wished that men of learning, especially philosophers, would not hastily, and by the first appearances, determine themselves with respect to the truth or falsehood, possibility or impossibility of things.

A person who has made but little progress in the mathematics, though in other respects learned and judicious, would be apt to pronounce it impossible that two lines, which were nowhere two inches asunder, may continually approach towards one another, and yet never meet though continued to affinity; and yet the truth of this proposition may be easily demonstrated. And many, who are good mechanics, would be as apt to pronounce the same, if they were told, that though the teeth of one wheel should take equally deep into the teeth of three others, it should affect them in such a manner, that, in turning it any way round its axis, it should turn one of them the same way, another the contrary way, and the third no way at all.

No science abounds more with paradoxes than geometry: thus, that a right line should continually approach to the hyperbola, and yet never reach it, is a true paradox: and in the same manner a spiral may continually approach to a point, and yet not reach it in any number of revolutions, however great.

The Copernican system is a paradox to the common people; but the learned are all agreed as to its truth. Geometricians have of late been accused of maintaining paradoxes; and some do indeed use very mysterious terms in expressing themselves about asymptotes, the sums of infinite progressions, the areas comprehended between curves and their asymptotes, and the solids generated from these areas, the length of some spirals, &c. But all these paradoxes and mysteries amount to no more than this; that the line or number may be continually acquiring increments, and those increments may decrease in such a manner, that the whole line or number shall never amount to a given line or number. The necessity of admitting it is obvious from the nature of the most common geometrical figures: thus, while the tangent of a circle increases, the area of the corresponding sector increases, but never amounts to a quadrant. Neither is it difficult to conceive, that if a figure be concave towards a base, and have an asymptote parallel to the base (as it happens when we take a parallel to the asymptote of the logarithmic curve, or of the hyperbola, for a base), that the ordinate in this case always increases while the base is produced, but never amounts to the distance between the asymptote and the base. In like manner, a curvilinear area may increase while the base is produced, and approach continually to a certain finite space, but never amount to it; and a solid may increase in the same manner, and yet never amount to a given solid. See *M'Laurin's Fluxions*. See *Logarithmic Curve*.

PARADOXI, a sort of mimes or buffoons among the ancients, who entertained the people with extempore effusions of drollery. They were also called *Paradoxologi*, *Ordonarii*, *Neanicologi*, and *Aretalogi*. See Mimi.

PARAGAUDÆ, among the Romans, were wreaths of gold, or silk and gold, interwoven in, not sewed to their garments. The garment was sometimes of one colour with one paragaudæ; sometimes of two colours, with two paragaudæ; of three colours, with three paragaudæ, &c. They were worn both by men and women.

PARAGOGE, in *Grammar*, a figure whereby a letter or syllable is added to the end of a word, as *med*, for *me*; *dicier*, for *dici*, &c.

PARAGRAPH, in general, denotes a section or division of a chapter; and in references is marked thus, ¶.

PARAGUAY, or La Plata, a province of Spanish America, bounded on the north by the river of the Amazons; on the east, by Brazil; on the south, by Patagonia; and on the west, by Chili and Peru. This

Paraguay. This country was first discovered by Sebastian Cabot, who, in 1526, passed from Rio de la Plata to the river Parana in small barks, and thence entered the river called *Uruguay*. It was not, however, thoroughly reduced till the Jesuits obtained possession of it. A few of these went to Paraguay soon after the city of Assumption was founded, and converted about 50 Indian families, who soon induced many others to follow their example, on account of the peace and tranquillity they enjoyed under the fathers. They had long resisted the Spaniards and Portuguese; but the Jesuits, by learning their language, conforming to their manners, &c. soon acquired great authority among them; till at last, by steadily pursuing the same artful measures, they arrived at the highest degree of power and influence, being in a manner the absolute sovereigns of a great part of this extensive country; for above 350,000 families are said to have been subject to them, living in obedience and awe bordering on adoration, yet procured without the least violence or constraint.

Gent. Mag. 1753. We have the following particular account of the missions of Paraguay, in the words of Don Jorge Juan, &c. "The territories of the missions of Paraguay comprehended not only the province of that name, but also a great part of the provinces of Santa Cruz de la Sierra, Tucuman, and Buenos Ayres. The temperature (A) of the air is good, though somewhat moist, and in some parts rather cold: the soil in many places is fertile (B); and produces in great abundance not only the fruits and vegetables peculiar to America, but also those of Europe which have been introduced there. The chief articles of their commerce are cotton, tobacco, some sugar, and the herb called *Paraguay*. Every town gathers annually more than 2000 arrobas of cotton, of a quarter of an hundred weight each, which the Indians manufacture into stuffs. There are also great quantities of tobacco produced. But the chief article is the herb Paraguay: for it grows only in the districts of the missions; and there is a vast consumption of this herb in all the provinces of Chili and Peru, especially of that called *camini*, which is the pure leaf; the infusion of which is called *mate*, and is drank by the inhabitants of Lima twice a day in lieu of tea or chocolate. The mate which is made by the infusion of the stalk is not so much esteemed.

"'Tis now almost two centuries since these missions were first set on foot by the Jesuits. The bad management of the Portuguese greatly favoured the views of these fathers. There was a nation of Indians called *Guaranies*, some whereof were settled upon the banks of the rivers Uruguay and Parana, and others a hundred leagues higher up in the country to the north-west of Guayra. The Portuguese frequently came upon them, and by force carried away as many as they thought proper to their plantations, and made slaves of them. Offended by such treatment, the Guaranies resolved to quit their settlements in the neighbourhood of the Portuguese, and to remove into the province of Paraguay. Accordingly a migration of 12,000 persons, great and small, ensued. These the Jesuits soon converted; and having had the like success in converting about an equal number of the natives of Tape, a district in Paraguay, they united the two nations, and laid the foundation of their future dominion. These fathers seem to have trode in the steps of the first Incas, and to have civilized nations and converted souls in order to acquire subjects. According to a very exact account taken in the year 1734, there were then 32 towns of the Guaranies, which were reckoned to contain above 30,000 families; and as the new converts were continually increasing, they were then about laying the foundations of three new towns. There were also then seven very populous towns inhabited by the converted Chiquito Indians, and they were preparing to build others for the reception of the new converts of that nation which were daily made.

"The missions of Paraguay are surrounded on all sides with wild or unconverted Indians; some of whom live in friendship with the towns, but others harass them by frequent incursions. The father missionaries frequently visit those Indians, and preach to them; and from these expeditions they seldom return without bringing along with them some new converts to incorporate with their civilized subjects. In the performance of this duty they sometimes penetrate 100 leagues into those uncultivated tracts where wild Indians range; and it is observed that they meet with the least success amongst those nations with whom any fugitive Mestizos, or Spanish criminals, have taken refuge. The diligence of these fathers is certainly worthy the imitation of the Protestant clergy.

"Every town has its curate, who is assisted by one, and very often by two priests of the same order, according to the largeness and extent of the town and its district. These two or three priests, together with six boys who assist them in the service of the church, form a small college in every town, wherein the hours and other exercises are regulated with the same formality and exactness as in the large colleges in the cities of Peru and Chili. The most troublesome part of the duty of

(A) The climate of Paraguay differs but little from that of Spain; and the distinctions between the seasons are much the same. In winter, violent tempests of wind and rain are very frequent, accompanied with such dreadful claps of thunder and lightning as fill the inhabitants with terror and consternation. In summer, the excessive heats are mitigated by gentle breezes, which constantly begin at eight or nine in the morning.

(B) It produces maize, manioc, and potatoes, besides many fruits and simples unknown in Europe. Vines, however, do not thrive, except in some particular places. Wheat has also been tried; but it is only used for cakes, and other things of that kind. There are great numbers of poisonous serpents, and others of enormous size, many of which live on fish. It produces also abundance of sugar, indigo, pimento, ipecacuanha, and variety of other drugs; and above all the herb Paraguay, which it exports to the value of 100,000l. annually, to the provinces of Chili and Peru. The manner of using it is, to dry and reduce it almost to powder, then put it into a cup with lemon juice and sugar; boiling water is then poured on it, and the liquor drank as soon as may be. It is supposed to be serviceable in all disorders of the head, breast, and stomach; it preserves the miners from the noxious mineral steams with which they would otherwise be suffocated; it is a sovereign remedy in putrid fevers and the scurvy; allays hunger; and purifies all kind of water, by infusing it therein.

of the assistant priests are the personal visitations which they are obliged to make to the Indians to prevent their giving themselves up to idleness; for such is the slothfulness of the Guaranies, that if they were not very carefully looked after, the society would receive no benefit or advantage from them. They also attend the public shambles, where the cattle necessary for the sustenance of the Indians are daily slaughtered, and distribute the flesh amongst all the families in the town, in proportion to the number of persons whereof each family consists; so that all may have what is necessary, none what is superfluous. They also visit the sick, and see that they are properly taken care of. They are generally employed the whole day in these affairs, so that they have seldom time to assist the curate in his spiritual functions. All the boys and girls in the parish go to church every day in the week (except on festivals and Sundays), where they are instructed by the curate. On Sundays the whole parish goes to church to be instructed. The curate is besides obliged to go to confess the sick, and to administer the viaticum to those who desire it, and also to perform all the other functions peculiar to this office. In strictness the curate should be appointed in this manner. The society should nominate three persons to the governor of Buenos Ayres (in whose government the missions of Paraguay are included), as being vice patron of the missions, that he may choose one of them for curate; and the curates should be instructed in the duties of their office by the bishop: but as the provincials of the order can best judge who are properly qualified for the office, the governor and bishop have ceded their rights to them, and by them the curates are always appointed. The missions of the Guaranies and the missions of the Chiquitos, into which the missions of Paraguay are divided, have each their distinct father-superior, by whom the coadjutors or assistant curates of the several towns in the respective divisions are appointed. These superiors are continually visiting the towns, to see that they be well governed, and to endeavour to improve and augment them. They likewise from time to time take care to send out some fathers of the order into the countries of the wild Indians to make new converts. The better to enable him to discharge these duties, the superior of the Guaranies is assisted by two vice superiors; one of whom resides in Parana, the other upon the banks of the river Uruguay, and the superior himself resides in the town of Candelaria. The post of superior of the Chiquitos is not near so troublesome as that of the superior of the Guaranies: for the Chiquitos are not only less numerous, but much more docile and industrious than the Guaranies, so that they need not be continually watched and attended in order to prevent their idleness. The king allows an annual stipend of 300 pezas to each curate of the Guaranies, for the maintenance of himself and his assistants. The money is paid to the superior, who issues out monthly to each curate as much as is necessary for his subsistence; and when they want any thing extraordinary, their wants are supplied upon application to him. But the Chiquitos maintain their own curates. In every town there is a plantation set apart for the maintenance of the curate, which is cultivated by the joint labour of all the inhabitants. The produce of these plantations is generally more than sufficient for the subsistence of the curates, and the surplus is sold to buy ornaments for the churches. Nor are the curates the spiritual rectors of the towns only; they are also in effect the civil governors. It is true there are in every town of the missions a governor, regidores, and alcaldes, as there are in the other towns and cities under the Spanish government. But though the governor is elected by the Indians, he must be approved by the curate before he enters upon his office; nor can he chastise or punish delinquents without the curate's permission. The curate examines those who are accused of offences; and if he finds them guilty, delivers them to the governor to be punished, according to the nature and quality of the offence committed. He sometimes orders them to be imprisoned for a few days, sometimes to fast, and, when the fault is considerable, to be whipped, which is the severest punishment that is ever inflicted; for the regulations and instructions of the curates have been so efficacious, that murder and such like heinous crimes are never here committed. And even before they undergo these gentle corrections, the curate discourses the offenders in a mild friendly manner; and endeavours to excite in them a due sense of their crime, and of the ill consequences that might flow from it, and to convince them that they merit a much greater punishment than is inflicted. This mild treatment prevents tumults and insurrections, and acquires the curates universal veneration and esteem. The alcaldes are chosen annually by the regidores. The governor, regidores, and alcaldes are all Indians of the best capacities; and are in effect only so many overseers appointed by the curate, and dignified with these empty titles.

Every town has its armory or magazine, in which are lodged the fire-arms or other weapons wherewith the militia are armed when they take the field to repel the irruptions of the Portuguese and wild Indians. The militia are very dexterous and expert in the management of their arms; and are exercised on the eves of festivals in the squares or public places of the towns. The militia is composed of all those who are able to bear arms: they are formed into companies, which have each a proper number of officers, chosen from amongst those who are most distinguished for judgment and conduct. The dress of the officers is rich, adorned with gold and silver, and the device of the town to which they belong: they always appear in their uniforms on festivals, and on the days of military exercise. The governor, alcaldes, and regidores have also proper robes and dresses suitable to their respective offices, in which they appear on public occasions. There are schools in every town, in which the common people are taught reading and writing, and also music and dancing; in which arts they become very skilful. The Jesuits are very careful in consulting the natural bent and genius of their scholars, and in directing their studies and application accordingly. The lads of the most promising genius are taught the Latin tongue with great success. In one of the court yards of every curate's house are various shops or workhouses of painters, carvers, gilders, silversmiths, carpenters, weavers, and clockmakers, and of several other mechanics and artizans, who daily work for the public under the direction of the coadjutors, and at the same time teach the youth their respective arts and occupations.

The churches are large, well built, finely decorated and

Paraguay. and enlightened, and not inferior to the richest in Peru. Each church has a choir of music, composed of instruments of all sorts, and very good voices; so that divine service is celebrated here with as much pomp and solemnity as in cathedrals: nor are the public processions less splendid, especially that of the host; which, whenever it is carried abroad, is attended by the governor, alcaldes, and regidores, in their robes, and also by the militia in a body. The houses of the Indians are as well built and as well furnished as most of the Spanish houses in Peru. The greatest part indeed have mud walls, others are built with brick, and some with stone, but all are covered with tiles. In every town there is a house where gunpowder is made, that they may never want it when they are obliged to take arms, and always have it ready to make artificial fireworks on rejoicing days: for all festivals are here observed with as great ceremony and exactness as in the greatest cities. Upon the proclamation of a new king of Spain, the governors, alcaldes, regidores, and officers of the militia, appear dressed in new robes and uniforms of a different fashion from those they wore before. There is a sort of convent in every town; in one part whereof are confined women of an ill life, and the other part is destined for the reception of married women who have no family, and who retire thither when their husbands are absent. For the maintenance of this house, and for the support of orphans, and of old and infirm people, all the inhabitants of the town work two days in every week; and the profits of their labour, which is called *the labour of the community*, are set apart for the purpose. If the produce of this labour be more than is necessary for their subsistence, the surplus is laid out to buy ornaments for the churches, and clothes for the orphans and aged and infirm people; so that here are no beggars, nor any who want the necessaries of life. In short, by the wise policy and prudent regulations of the Jesuits, the whole community enjoys peace and happiness.

"The Guaranies are so profuse and negligent, that the curates are obliged to take into their hands all their goods and stuffs as soon as they are manufactured and made ready for sale; otherwise they would waste and destroy them, and not be able to maintain themselves. The Chiquitos, on the contrary, are diligent and frugal; so that the curates have no other trouble with them than the assisting them in the disposal of their goods, and procuring returns for them. For this purpose the society keeps a factor or procurator at Santa Fé and Buenos Ayres, to whom the merchandise of the missions is sent to be disposed of; and these factors return the value to the fathers in such sort of European commodities as are wanted. The goods of every town are kept separate; and the royal taxes are taken out of them without any other discount or allowances, save the stipends of the curates of the Guaranies and the pensions of the caciques. The fathers choose to manage the commerce of their subjects themselves, lest they should contract vices by their communication with other people. In this respect the fathers are so careful, that they will not suffer any of the people of Peru, whether they be Spaniards, Mestizos, or Indians, to enter into the territories of the missions. However, there are some who suspect that these are all specious pretences; and that the society's real motive for prohibiting all intercourse with strangers, is the fear of rivals in the beneficial commerce of Paraguay, which is now entirely in their hands." Paraguay.

Such is the account they themselves have given us of their own conduct: but others have treated their characters with more severity; accusing them of pride, haughtiness, and abusing their authority to the greatest degree; insomuch that they would have caused the magistrates to be whipped in their presence, and obliged persons of the highest distinction within their jurisdiction to kiss the hem of their garment, as the greatest honour at which they could possibly arrive. To this might be added, the utter abolition of all ideas of property; which indeed was rendered useless by the general magazines and storehouses, which they established, and from which, together with the herds of cattle kept for the public use, they supplied the wants of individuals as occasion required; yet still it was objected to the character of the fraternity, that they possessed large property themselves, and claimed the absolute disposal of the meanest effects in Paraguay. All manufactures belonged to them; every natural commodity was brought to them: and the treasures annually remitted to the superior of the order were thought to be a proof that zeal for religion was not the only motive by which they were influenced.

Besides the parochial or provincial governments, there was a kind of supreme council, composed of an annual meeting of all the fathers, who concerted the measures necessary for promoting the common concerns of the mission, framed new laws, corrected or abolished old ones, and, in a word, adapted every thing to circumstances. It is said to have been one of the great objects of the annual councils to take such measures as should effectually deprive strangers of all intelligence concerning the state of the mission. Hence the natives were restrained from learning the Spanish tongue, and were taught, that it was dangerous for their salvation to hold any conversation with a subject of Spain or Portugal. But the circumstance that rendered their designs most suspicious, was the establishment of a military force. Every parish had its corps of horse and foot, who were duly exercised every Sunday; and it was said, that the whole amounted to a body of 70,000 or 80,000 troops, well disciplined.

The city of Buenos Ayres, the metropolis of this vast province, was taken by the naval and military forces of his Britannic majesty, under the command of Sir Home Popham and Major-general Beresford, on the 26th of June 1806. It was attacked on the 9th of August the same year, by a detachment of Spanish troops from Monte Video, and obliged to surrender on the 12th under a capitulation, the terms of which were not afterwards observed; and General Beresford, the officers, troops, marines of the squadron, and a few seamen, remained prisoners of war. A more considerable force, under the command of Lieutenant-general Whitelocke, was afterwards sent to reduce it. That officer, after a number of skirmishes and partial engagements with the enemy, in which the officers and troops under his command exhibited abundant proofs of great bravery, thought proper to abandon the idea of reducing the town. The reason assigned by him for this mysterious conduct, the dread that all the prisoners would be massacred by an exasperated mob, might have done honour to his humanity, but it is extremely doubtful whether or not that was founded on fact. The British government

Paraguay ‖ Paralipomena.

government certainly thought otherwise, and the degrading sentence of the court martial by which he was tried, gives us reason to conclude that his anxiety for the life of General Beresford and the rest of the British prisoners was nothing more than a pretext.

Since the failure of the British expedition, this colony has been the theatre of an important revolution. When the news arrived at Buenos Ayres, in 1810, of the dispersion of the central junta by the French in Old Spain, the viceroy Cisneros, by the advice of the cabildo, called a congress, which appointed a junta. The junta, which commenced its sittings on 25th May 1810, was opposed by the Spanish authorities in Monte Video and some of the other provinces, and afterwards by the viceroy and members of the audiencia. The latter were exiled, the forces marching against the city were defeated, and Liniers and other leaders executed. The new government of Buenos Ayres now sent a force into Chili, which effected a revolution there, and even threatened Lima. The royalists, however, made head again, and battles were lost and won by both parties; but the independents have finally established themselves in Chili, though Peru is still in the hands of their opponents. The independents were long annoyed by the royalists in Monte Video, but in June 1814 the town fell into their hands. But Artigas, one of their own officers, having abandoned their cause, got possession of the town next, and held it by his own authority, till he was dispossessed in January 1817 by the Portuguese, who had long wished to extend their territories in this direction. In the mean time the government of Buenos Ayres was a prey to anarchy. The congress and the juntas were distracted by furious factions. Sometimes the municipality displaced the civil authorities, or one member of the government deposed the others, or the military commanders seized the supreme power by force. At length, in July 1816, Don J. M. Puyrredon was appointed supreme director, and has ever since continued to administer the public affairs with great steadiness and moderation. The independence of the provinces of La Plata was formally announced by the congress on the 9th July 1816. From the report of the American commissioners, Messrs Graham and Rodney (Dec. 1818), it appears that the government is now well consolidated, the press enjoys a great degree of freedom, information and industry are increasing, religious toleration is making progress, and the situation of the people has been in every respect much ameliorated. They have kept an army in Chili for some years; and have lately organized a respectable naval force, the command of which has been given to our countryman Lord Cochrane. The population of the whole provinces, in 1818, has been estimated at 1,300,000, exclusive of Indians. But according to Mr Graham, one of the American commissioners, the population of those provinces which are represented in the congress is only about 489,000, excluding Indians; and adding the provinces of Upper Peru, the population does not exceed one million. The foreign trade is chiefly with Britain. According to a parliamentary paper, the exports to Buenos Ayres in 1818, were 730,808l. See BUENOS AYRES and SOUTH AMERICA, SUPPLEMENT.

PARALIPOMENA, in matters of literature, denotes a supplement of things omitted in a preceding work.

Paralepsis ‖ Parallax.

PARALEPSIS, See ORATORY, N° 87.

PARALLACTIC, in general, something relating to the parallax of heavenly bodies. See PARALLAX.

PARALLAX, in *Astronomy*, is the difference between the places of any celestial object, as seen from the surface and from the centre of the earth at the same instant.

1 Illustration. Plate CCCCIV.

Let E in figure of parallax, represent the centre of the earth, O the place of an observer on its surface, whose visible horizon is OH, and true horizon EF: Now let ZDT be a portion of a great circle in the heavens, and A the place of any object in the visible horizon; join EA, and produce it to C; then C is the *true* place of the object, and H is its *apparent* place, and the angle CAH is the parallax; or, because the object is in the horizon, it is called the *horizontal parallax*. But OAE, the angle which the earth's radius subtends at the object, is equal to CAH: Hence the horizontal parallax of an object may be defined to be the angle which the earth's semidiameter subtends at that object. For the various methods hitherto proposed to find the quantity of the horizontal parallax of an object, see ASTRONOMY.

The whole effect of parallax is in a vertical direction: For the parallactic angle is in the plane passing through the observer and the earth's centre; which plane is necessarily perpendicular to the horizon, the earth being considered a sphere.

2 The parallax decreases with the distance of the object from the zenith.

The more elevated an object is above the horizon, the less is the parallax, its distance from the earth's centre continuing the same. When the object is in the zenith, it has no parallax; but when in the horizon, its parallax is greatest. The horizontal parallax being given, the parallax at any given altitude may be found by the following rule.

3 The sine of the parallax in alt. is to the sine of the hor. par. as the cosine of apparent altitude is to the radius.

To the logarithmic cosine of the given altitude, add the log. sine of the horizontal parallax, the sum, rejecting 10 from the index, will be the log. sine of the parallax in altitude.

Demonstration. Let B be the place of an object; produce OB, ED to F and D; then the angle BOZ will be the apparent altitude of the object, BEZ the true altitude, and OBE the parallax in altitude. Now in the triangle AOE.

R : sine OAE :: EA : EO.

And in the triangle OBE

BE (=EA : EO :: sine BOE : sine OBE.

Hence R : cosine BOA :: sine OAE : sine OBE.

As the two last terms are generally small quantities, the arch may be substituted in place of its sine without any sensible error.

Example. Let the apparent altitude of the moon's centre be 39° 25′, and the moon's horizontal parallax 56′ 54″. Required the parallax in altitude.

Moon's apparent alt.	39° 25′	cosine 9.8879260
Moon's horizontal par.	56′ 54″	sine 8.2188186
Moon's par. in altitude	43′ 57″	sine 8.1067446

Or, to the secant of the moon's apparent altitude, add the proportional logarithms of the parallax in altitude.

As the apparent place of an object is nearer the horizon than its true place, the parallax is therefore to be added to the apparent altitude, to obtain the true altitude. Hence also an object will appear to rise later and set sooner.

The

The sine of the parallax of an object is inversely as its distance from the earth's centre.

4 The sine of the parallax of an object in the inverse ratio of its distance from the earth's centre.

Demonstration. Let A be the place of an object, and H the place of the same object at another time, or that of another object at the same instant; join EH, then in the triangles AOE, HOE,

R : sine OAE : : AE : OE

sine OHE : R : : OE : EH

Hence sine OHE : sine OAE : : AE : EH.

The parallax of an object makes it appear more distant from the meridian than it really is.

5 Parallax increases the apparent distance of an object from the meridian.

Demonstration. The true and apparent places of an object are in the same vertical, the apparent place being lower than the true; and all verticals meet at the zenith: Hence the apparent place of an object is more distant from the plane of the meridian than the true place.

6 Parallax in longitude, latitude, right ascension, and declination.

The longitude, latitude, right ascension, and declination of an object are affected by a parallax. The difference between the true and apparent longitudes is called the *parallax in longitude;* in like manner, the difference between the true and apparent latitudes, right ascensions, and declinations, are called the *parallax in latitude, right ascension,* and *declination,* respectively.—When the object is in the nonagesimal, the parallax in longitude is nothing, but that in latitude is greatest: and when the object is in the meridian, the parallax in right ascension vanishes, and that in declination is a maximum. The apparent longitude is greater than the true longitude, when the object is east of the nonagesimal, otherwise less; and when the object is in the eastern hemisphere, the apparent right ascension exceeds the true, but is less than the true right ascension when the object is in the western hemisphere. The apparent place of an object is more distant from the elevated poles of the ecliptic and equator than the true place: hence, when the latitude of the place and elevated pole of the ecliptic are of the same name, the apparent latitude is less than the true latitude, otherwise greater; and the apparent declination will be less or greater than the true declination, according as the latitude of the place, and declination of the object, are of the same or of a contrary denomination.

The parallaxes in longitude, latitude, right ascension, and declination, in the spheroidal hypothesis, may be found by the following formulæ; in which L represents the latitude of the place, diminished by the angle contained between the vertical and radius of the given place; P the horizontal parallax for that place; a the altitude of the nonagesimal at the given instant; d the apparent distance of the object from the nonagesimal; $l\,\lambda$ the true and apparent latitudes of the object; $D\,\delta$ the true and apparent declinations respectively; and m its apparent distance from the meridian.

Then par. in long. $=$ P sine a. sine d. secant l, to radius unity; and par. in lat. $=$ P. cosine a, cosine $\lambda \mp p$. cosine d. sine a. sine λ.

The sign — is used when the apparent distance of the object from the nonagesimal and from the elevated pole of the ecliptic are of the same affection, and the sign + if of different affection. If the greatest precision be required, the following quantity 0.00000121216. par. long.^{2}, sine 2 l, is to be applied to the parallax in latitude found as above, by addition or subtraction, according as the true distance of the object from the elevated pole of the ecliptic is greater or less than 90°.

Again, par. in right ascen. $=$ P. cosine L, sine m. secant D. to radius unity; and par. in declination $=$ P. sine L. cosine $\delta \mp$ P. cosine L. sine δ, cosine m.

The upper or lower sign is to be used, according as the distance of the object from the meridian and from the elevated pole of the equator are of the same or different affection. Part 2d of par. in declination $=$ 0.00000121216 par. in right ascen.^{2}, sine 2 D, which is additive to, or subtractive from, part first of parallax in declination, according as the true distance of the object from the elevated pole of the equator is greater or less than 90°. For the moon's parallax, see ASTRONOMY. There is also a curious paper in the first volume of Asiatic Researches, p. 320, &c. on the same subject, to which we refer our readers.

PARALLAX of the Earth's annual Orbit, is the difference between the places of a planet as seen from the sun and earth at the same instant. The difference between the longitudes of the planets as seen from the sun and earth is called the *parallax in longitude;* and the difference between its latitude is the *parallax in latitude.*

PARALLAX of the Fixed Stars. See ASTRONOMY, art. 268. which contains an account of the method used by Dr Herschel, to ascertain the parallax of a star which appears to be double, from observations made at opposite points of the orbit of the earth. M. Piazzi, the discoverer of the planet Ceres, has made many observations of the zenith distances of α Lyræ, Arcturus, Procyon, and Aquilæ, &c. at those times when the effects of parallax ought to be the greatest. His observations are published in the 10th volume of the Italian Society. Let p be the absolute parallax, consequently,

sine $p = \dfrac{1}{\text{distance of the star from the earth}}$; then the parallax of Arcturus in declination will be 0.595 p, and that in right ascension, 1.005p; hence, he observes, that observations of the right ascension of this star are preferable to those of the declination, for determining the parallax of this star.

M. Calendrelli, in a work printed at Rome in 1806, has given the result of his observations of the zenith distances of α Lyræ, made with the sector of Mess. Maire and Boscovich. By comparing five observations in June, with four in December 1805, and five in March with the same number in June, he deduced the parallax of α Lyræ in declination to be 4.″7, and that in right ascension 6.″85.—According to M. Piazzi, the parallax is less than half of these quantities; and, hence, the required quantity not exceeding the unavoidable differences attending observations, it appears difficult to determine it, so as to be free from doubt.

Mess. Delambre and Mechain have made many observations of the pole star, and β Ursæ minoris, being those stars which ought to have the greatest parallax in declination, at the times most proper to discover their parallax; but from the comparison, which M. Delambre made, of the zenith distances of these stars, he discovered nothing that could give the least suspicion of a parallax; and the small anomalies which he observed are often in a contrary direction. M. Delambre adds, that

that these stars being of the second magnitude, may be too far distant from us to have a parallax; however, although this may be the case, yet it appears to him that the fixed stars have no parallax.

The parallax of Venus affords the most correct method, hitherto proposed, of finding the distance of the earth from the sun; and, hence the distances of the other planets, and also their magnitudes. For this discovery we are indebted to the celebrated Dr Halley. From observations of the transits of this planet, in 1761 and 1769, the parallax of the sun has been more accurately determined than previous thereto. The parallax of Mars has also been employed for the same purpose.

PARALLAX, is also used to denote the change of place in any object arising from viewing it obliquely with respect to another object. Thus the minute hand of a watch is said to have a parallax when it is viewed obliquely; and the difference between the instants shown by it, when viewed directly and obliquely, is the quantity of parallax in time.

PARALLEL, in *Geometry*, an appellation given to lines, surfaces, and bodies, everywhere equidistant from each other. See GEOMETRY.

PARALLEL Sphere, that situation of the sphere wherein the equator coincides with the horizon, and the poles with the zeinth and nadir.

PARALLEL Sailing. See NAVIGATION, book i. chap. iv.

PARALLELS of Latitude, in *Astronomy*, are lesser circles of the sphere parallel to the ecliptic, imagined to pass through every degree and minute of the colures.

PARALLELS of Altitude, or *Almucantars*, are circles parallel to the horizon, imagined to pass through every degree and minute of the meridian between the horizon and zenith, having their poles in the zenith.

PARALLELS of Declination, in *Astronomy*, are the same with parallels of latitude in geography.

PARALLELOPIPED, in *Geometry*, a regular solid comprehended under six parallelograms, the opposite ones whereof are similar, parallel, and equal to each other.

PARALOGISM, in *Logic*, a false reasoning, or a fault committed in demonstration, when a consequence is drawn from principles that are false, or, though true, are not proved; or when a proposition is passed over that should have been proved by the way.

PARALYSIS, the PALSY. See MEDICINE *Index*.

PARAMARIBO, the capital of the former Dutch settlement of Surinam, situated about 18 miles from the mouth of a river of the same name. See SURINAM.

PARAMOUNT, (compounded of two French words, *par*, i. e. *per*, and *monter*, *ascendere*), signifies in our law the "highest lord of the fee, of lands, tenements, and hereditaments." As there may be a lord mesne where lands are held of an inferior lord, who holds them of a superior under certain services; so this superior lord is lord *paramount*. Also the king is the chief lord, or lord *paramount*, of all the lands in the kingdom. *Co. Lit.* 1.

PARANYMPH, among the ancients, the person who waited on the bridegroom, and directed the nuptial solemnities; called also *pronubus* and *auspex*, because the ceremonies began by taking auspicia. As the paranymph officiated only on the part of the bridegroom, a woman called *pronuba* officiated on the part of the bride.

PARAPET, in *Fortification*, an elevation of earth designed for covering the soldiers from the enemy's cannon or small shot. See FORTIFICATION.

PARAPHERNALIA, or PARAPHERNA, in the civil law, those goods which a wife brings her husband besides her dower, and which are still to remain at her disposal exclusive of her husband, unless there is some provision made to the contrary in the marriage contract. Some of our English civilians define the paraphernalia to be such goods as a wife challengeth over and above her dower or jointure, after her husband's death; as furniture for her chamber, wearing apparel, and jewels, which are not to be put into the inventory of her husband's goods; and a French civilian calls paraphernalia the moveables, linen, and other female necessaries, which are adjudged to a wife in prejudice of the creditors, when she renounces the succession of her husband.

PARAPHIMOSIS, a disorder of the penis, wherein the prepuce is shrunk, and withdrawn behind the glans, so as not to be capable of being brought to cover the same; which generally happens in venereal disorders. See SURGERY.

PARAPHRASE, an explanation of some text in clearer and more ample terms, whereby is supplied what the author might have said or thought on the subject. Such are esteemed Erasmus's Paraphrase on the New Testament, the Chaldee Paraphrase on the Pentateuch, &c.

PARAPHRENITIS, an inflammation of the diaphragm. See DIAPHRAGM, MEDICINE *Index*.

PARAPHROSYNE, a word used by medical writers to denote a delirium, or an alienation of mind in fevers, or from whatever other cause.

PARAPLEGIA, a species of palsy. See MEDICINE *Index*.

PARASANG, an ancient Persian measure, different at different times, and in different places; being usually 30, sometimes 40, and sometimes 50 stadia or furlongs. —The word, according to Littleton, has its rise from *parasch angarius*, q. d. the space a postman rides from one station, *angaria*, to another.

PARASCENIUM, in the Grecian and Roman theatres, was a place behind the scenes whither the actors withdrew to dress and undress themselves. The Romans more frequently called it *Postscenium*. See THEATRE.

PARASELENE, in *Natural Philosophy*, a mock moon; a meteor or phenomenon encompassing or adjacent to the moon, in form of a luminous ring; wherein are observed sometimes one and sometimes two or more images of the moon.

PARASEMON, among the Greeks, was the figure carved on the prow of the ships to distinguish them from each other. This figure was generally that of a bull, lion, or other animal; sometimes the representation of a mountain, tree, flower, &c.

PARASITE, among the Greeks, was originally a very reputable title; the parasites being a kind of priests, at least ministers, of the gods, in the same manner as the epulones were at Rome. They took care of the sacred corn, or the corn destined for the service of the temples and the gods, viz. sacrifices, feasts, &c. They had even the intendance over sacrifices; and took care that they were duly performed. At Athens there was a kind of college of twelve parasites; each people of Attica furnishing one, who was always chosen out of the best families. Polybius adds, that a parasite was also an honourable title among the ancient Gauls, and was given to their poets. But of late it has been made a term of reproach, and used for a flatterer or mean dependent.

PARASITES, or *Parasitical Plants*, in *Botany*, such plants as are produced out of the trunk or branches of other plants, from whence they receive their nourishment, and will not grow on the ground. Such are the misletoe, &c.

PARASTATÆ, in *Anatomy*. See Prostate.

PARATALASSIA. See Primorie.

PARBUNCLE, in a ship, the name of a rope almost like a pair of slings: it is seized both ends together, and then put almost double about any heavy thing that is to be hoisted in or out of the ship; having the hook of the runner hitched into it, to hoist it up by.

PARCÆ, in heathen mythology, goddesses who were supposed to preside over the accidents and events, and to determine the date or period, of human life.

The Parcæ were three, Clotho, Lachesis, and Atropos; because, forsooth, all things have their beginning, progress, and end. Hence the poets tell us, the Parcæ spun the thread of men's lives; that Clotho held the distaff, and drew the thread; Lachesis twirled the spindle, and spun it; and Atropos cut it. *Clotho colum retinet, Lachesis net, Atropos secat.*

The ancients represent the Parcæ divers ways: Lucian, in the shape of three poor old women, having large locks of wool, mixed with daffodils on their heads; one of which holds a distaff, the other a wheel, and the third a pair of scissars, wherewith to cut the thread of life. Others represent them otherwise: Clotho appearing in a long robe of divers colours, wearing a crown upon her head adorned with seven stars, and holding a distaff in her hand; Lachesis in a robe beset with stars, with several spindles in her hand; and Atropos, clad in black, cutting the thread with a pair of large scissars.

The ancients imagined that the Parcæ used white wool for a long and happy life, and black for a short and unfortunate one. See *Necessity*, in Mythology.

PARCHMENT, the skins of sheep or goats prepared after such a manner as to render it proper for writing upon, covering books, &c.

The word comes from the Latin *pergamena*, the ancient name of this manufacture; which is said to have been taken from the city Pergamos, to Eumenes king whereof its invention is usually ascribed; though, in reality, that prince appears rather to have been the improver than the inventor of parchment. For the Persians of old, according to Diodorus, wrote all their records on skins; and the ancient Ionians, as we are told by Herodotus, made use of sheep skins and goat skins in writing, many ages before Eumenes's time. Nor need we doubt that such skins were prepared and dressed for that purpose, after a manner not unlike that of our parchment; though probably not so artificially.—The manufacture of parchment is begun by the skinner, and finished by the parchment maker.

The skin having been stripped of its wool, and placed in the lime pit, in the manner described under the article Shammy, the skinner stretches it on a kind of frame, and pares off the flesh with an iron instrument; this done, it is moistened with a rag; and powdered chalk being spread over it, the skinner takes a large pumice stone, flat at bottom, and rubs over the skin, and thus scours off the flesh; he then goes over it again with an iron instrument, moistens it as before, and rubs it again with the pumice stone without any chalk underneath: this smooths and softens the flesh side very considerably. He then drains it again, by passing over it the iron instrument as before. The flesh side being thus drained, by scraping off the moisture, he in the same manner passes the iron over the wool or hair side: then stretches it on a frame, and scrapes the flesh side again: this finishes its draining; and the more it is drained the whiter it becomes. The skinner now throws on more chalk, sweeping it over with a piece of lamb skin that has the wool on; and this smooths it still farther. It is now left to dry, and when dried, taken off the frame by cutting it all round. The skin thus far prepared by the skinner, is taken out of his hands by the parchment maker, who first, while it is dry, pares it on a summer, (which is a calf skin stretched in a frame), with a sharper instrument than that used by the skinner; and working with the arm from the top to the bottom of the skin, takes away about one half of its thickness. The skin thus equally pared on the flesh side, is again rendered smooth, by being rubbed with the pumice stone, on a bench covered with a sack stuffed with flocks; which leaves the parchment in a condition fit for writing upon. The parings thus taken off the leather, are used in making glue, size, &c. See the article Glue, &c.

What is called *vellum* is only parchment made of the skins of abortives, or at least sucking calves. This has a much finer grain, and is whiter and smoother than parchment; but is prepared in the same manner, except its not being passed through the lime pit.

PARDALIS. See Felis, Mammalia *Index*.

PARDIES, Ignatius Gaston, an ingenious and learned French Jesuit, born at Paris in 1636. He taught polite literature for several years; during which time he composed several small pieces, both in prose and verse, with peculiar delicacy of thought and style. At length he devoted himself entirely to mathematics and natural philosophy, and read all authors, ancient as well as modern, in those branches of knowledge. He died in 1673, of an infectious disorder contracted by confessing and preaching to the prisoners in the Bicetre during the Easter holidays. Father Pardies published several works; of which his Elements of Geometry are well known in this country, where a translation of them has gone through several editions. In 1672 he had a dispute with Sir Isaac Newton respecting the Theory of Light and Colours; which may be seen in the Philosophical Transactions for that year.

PARDON, in *Criminal Law*, is the remitting or forgiving an offence committed against the king.

Law (says an able writer) cannot be framed on principles of compassion to guilt; yet justice, by the constitution of England, is bound to be administered in mercy: this is promised by the king in his coronation oath; and it is that act of his government which is the most personal and most entirely his own. The king condemns no man; that rugged task he leaves to his courts *Beccaria on Crimes and Punishments.*

Pardon.

of justice; the great operation of his sceptre is mercy. His power of pardoning was said by our Saxon ancestors to be derived *à lege suæ dignitatis:* and it is declared in parliament, by stat. 27 Hen. VIII. c. 24. that no other person hath power to pardon or remit any treason or felonies whatsoever; but that the king hath the whole and sole power thereof, united and knit to the imperial crown of this realm.

This is indeed one of the greatest advantages of monarchy in general above any other form of government, that there is a magistrate who has it in his power to extend mercy wherever he thinks it is deserved; holding a court of equity in his own breast, to soften the rigour of the general law, in such criminal cases as merit an exemption from punishment. Pardons (according to some theorists) should be excluded in a perfect legislation, where punishments are mild, but certain; for that the clemency of the prince seems a tacit disapprobation of the laws. But the exclusion of pardons must necessarily introduce a very dangerous power in the judge or jury; that of construing the criminal law by the spirit instead of the letter; or else it must be holden, what no man will seriously avow, that the situation and circumstances of the offender (though they alter not the essence of the crime) ought to make no distinction in the punishment. In democracies, however, this power of pardon can never subsist; for there nothing higher is acknowledged than the magistrate who administers the laws: and it would be impolitic for the power of judging and of pardoning to centre in one and the same person. This (as the president Montesquieu observes) would oblige him very often to contradict himself, to make and to unmake his decisions: it would tend to confound all ideas of right among the mass of people; as they would find it difficult to tell, whether a prisoner were discharged by his innocence, or obtained a pardon through favour. In Holland, therefore, if there be no stadtholder, there is no power of pardoning lodged in any other member of the state. But in monarchies the king acts in a superior sphere; and though he regulates the whole government as the first mover, yet he does not appear in any of the disagreeable or invidious parts of it. Whenever the nation see him personally engaged, it is only in works of legislature, munificence, or compassion. To him therefore the people look up as the fountain of nothing but bounty and grace; and these repeated acts of goodness, coming immediately from his own hand, endear the sovereign to his subjects, and contribute more than any thing to root in their hearts that filial affection and personal loyalty which are the sure establishment of a prince.

The king may pardon all offences merely against the crown or the public; excepting, 1. That, to preserve the liberty of the subject, the committing any man to prison out of the realm, is, by the *habeas corpus* act, 31 Car. II. c. 2. made a *præmunire*, unpardonable even by the king. Nor, 2. can the king pardon, where private justice is principally concerned in the prosecution of offenders: *Non potest rex gratiam facere cum injuria et damno aliorum.* Therefore, in appeals of all kinds (which are the suit, not of the king, but of the party injured), the prosecutor may release; but the king cannot pardon. Neither can he pardon a common nuisance, while it remains unredressed, or so as to prevent an abatement of it; though afterwards he may remit the fine: because though the prosecution is vested in the king to avoid the multiplicity of suits, yet (during its continuance) this offence savours more of the nature of a *private* injury to each individual in the neighbourhood, than of a *public* wrong. Neither, lastly, can the king pardon an offence against a popular or penal statute, after information brought: for thereby the informer hath acquired a private property in his part of the penalty.

There is also a restriction of a peculiar nature, that affects the prerogative of pardoning, in case of parliamentary impeachments, viz. that the king's pardon cannot be pleaded to any such impeachment, so as to impede the inquiry, and stop the prosecution of great and notorious offenders. Therefore, when in the reign of Charles II. the earl of Danby was impeached by the house of commons of high treason and other misdemeanors, and pleaded the king's pardon in bar of the same, the commons alleged, "That there was no precedent that ever any pardon was granted to any person impeached by the commons of high treason, or other high crimes, depending the impeachment;" and thereupon resolved, "That the pardon so pleaded was illegal and void, and ought not to be allowed in bar of the impeachment of the commons of England:" for which resolution they assigned this reason to the house of lords, "That the setting up a pardon to be a bar of an impeachment defeats the whole use and effect of impeachments: for should this point be admitted, or stand doubted, it would totally discourage the exhibiting any for the future; whereby the chief institution for the preservation of the government would be destroyed." Soon after the Revolution, the commons renewed the same claim, and voted, "That a pardon is not pleadable in bar of an impeachment." And at length, it was enacted by the act of settlement, 12 and 13 W. III. c. 2. "That no pardon under the great seal of England shall be pleadable to an impeachment by the commons in parliament." But, after the impeachment has been solemnly heard and determined, it is not understood that the king's royal grace is farther restrained or abridged: for, after the impeachment and attainder of the six rebel lords in 1715, three of them were from time to time reprieved by the crown; and at length received the benefit of the king's most gracious pardon.

The effect of such pardon by the king, is to make the offender a new man; to acquit him of all corporal penalties and forfeitures annexed to that offence for which he obtains his pardon; and not so much to restore his former, as to give him a new credit and capacity. But nothing can restore or purify the blood when once corrupted, if the pardon be not allowed till after attainder, but the high and transcendent power of parliament. Yet if a person attainted receive the king's pardon, and afterwards hath a son, that son may be heir to his father; because the father being made a new man, might transmit new inheritable blood; though, had he been born before the pardon, he could never have inherited at all.

Such is the nature of pardons in this kingdom. These, like other good things, may doubtless be abused; and if they are in any instance, their abuse deserves censure: but that in their nature they should be counted absurd, arbitrary, and destructive of morality, can, we suspect, Pardon.

suspect, proceed from nothing but from the presumptive petulance of modern reformers, or from the new system of civil equality.

Godwin's Inquiry concerning Political Justice.

We are told, however, by a late champion for the Rights of Man, that "the very word to a reflecting mind is fraught with absurdity. 'What is the rule that ought in all cases to prescribe to my conduct?' Surely justice: understanding by justice the greatest utility of the whole mass of things that may be influenced by my conduct. 'What then is clemency?' It can be nothing but the pitiable egotism of him who imagines he can do something better than justice. 'Is it right that I should suffer constraint for a certain offence?' The rectitude of my suffering must be founded in its tendency to promote the general welfare. He therefore that pardons me, iniquitously prefers the imaginary interest of an individual, and utterly neglects what he owes to the whole. He bestows that which I ought not to receive, and which he has no right to give. 'Is it right, on the contrary, that I should not undergo the suffering in question? Will he, by rescuing me from suffering, do a benefit to me, and no injury to others?' He will then be a notorious delinquent, if he allow me to suffer. There is indeed a considerable defect in this last supposition. If, while he benefits me, he do no injury to others, he is infallibly performing a public service. If I suffered in the arbitrary manner which the supposition includes, the whole would sustain an unquestionable injury in the injustice that was perpetrated. And yet the man who prevents this odious injustice, has been accustomed to arrogate to himself the attribute of clement, and the apparently sublime, but in reality tyrannical, name of forgiveness. For, if he do more than has been here described, instead of glory he ought to take shame to himself, as an enemy to the interest of human kind. If every action, and especially every action in which the happiness of a rational being is concerned, be susceptible of a certain rule, then caprice must be in all cases excluded: there can be no action, which, if I neglect, I shall have discharged my duty; and, if I perform, I shall be entitled to applause."

Such is the reasoning of this singular writer; reasoning which, in our opinion, betrays want of feeling or ignorance of human nature. That human nature is such, as, in the aggregate, to need controul, no one who is acquainted with it will deny; and there appears to be no other method of controuling mankind but by general laws; and these laws may, through the natural imperfection of human affairs, be cruel in one case, where they are just in another. Cases may likewise occur where the sentence of the law, without its execution, will answer every purpose which could be expected from it: and where the execution of it would be extreme cruelty, though it might in strict unfeeling language be called *justice*, because in conformity with the letter of the law: Yet though such cases may and do often occur, it would indeed be absurd to abolish any of those laws which the security of civil society has required; and therefore the only natural remedy against *legal injustice* is *the system of pardons*.

Our author next goes on to trace the origin of pardons; and instead of a definite system of law, we are told that it is necessary to have a court of reason, to which the decisions of a court of law shall be brought for revisal: a remedy apparently too vague and indeterminate to produce any lasting or good effect; and the proposal of which results from supposing mankind more virtuous and more knowing than they really are. We are next led to consider the abuses of pardons: from whence our author would draw an argument for their abolition; a species of reasoning unfair and unphilosophical. He tells us, that the authority in this case is placed first in the judge, and next in the king and council. "Now (says he), laying aside the propriety or impropriety of this particular selection, there is one grievous abuse which ought to strike the most superficial observer. These persons with whom the principal trust is reposed, consider their functions in this respect as a matter purely incidental, exercise them with supineness, and in many instances with the most scanty materials to guide their judgment. This grows in a considerable degree out of the very name of pardon, which implies a work of supererogatory benevolence."

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Now it is obvious to remark, that pardons are in general granted in consequence of an application from people who have more *than scanty materials to guide their judgments*, and on whose fidelity in relating the circumstances of the case, confidence is placed or not according to their several characters. Our author next proceeds to the arbitrary character of pardons. "Such a system (he says), to speak it truly, is a lottery of death, in which each man draws his ticket for reprieve or execution, as undefinable accidents shall decide." The allusion here to a lottery ticket is peculiarly unfortunate and indelicate, nor does the whole sentence show any great degree of candour. It is possible to define a particular crime, and to annex a particular punishment to the commission of it; but the nature of morality consists not in the external action, but in the motives which prompted to it. Definite law cannot, however, always make this distinction; and after the sentence of the law is pronounced, it comes to be considered whether there are any alleviating circumstances in the case; and whether there are or not, must depend on the particulars or accidents of the case: and it is indeed impossible to suppose that these accidents could be previously defined; their nature does not admit of it. To particularize and define every mode of an action which imagination can conceive, or which experience has shown us may happen, would indeed be an Herculean labour; and we might literally say with the apostle, *that the world could not contain the books that might be written.* We are, however, told, that "reason is a thousand times more explicit and intelligible than law; and when we are accustomed to consult her, the certainty of her decisions would be such, as men practised in our present courts are totally unable to conceive." Were reason, however, appointed to be appealed to in all cases, and to be the final criterion, it would leave far greater room for villany than any mode at present in practice. *Reason* is a very uncertain and indefinite term, and may be made any thing, according to the circumstances or passions of men. Our reforming neighbours the French have raised a statue to *reason* and to *truth;* but what claim they have to either, Mr Godwin must himself decide.

We are next told that pardons are destructive to morality. "Another very important consequence (says our author) grows out of the system of pardons. A system of pardons is a system of unmitigated slavery. I am taught

Pardon || Parenchyma.

taught to expect a certain desirable event; from what? From the clemency, the uncontrouled, unmerited kindness of a fellow mortal. Can any lesson be more degrading? The pusillanimous servility of the man, who devotes himself with everlasting obsequiousness to another, because that other having begun to be unjust, relents in his career; the ardour with which he confesses the rectitude of his sentence and the enormity of his deserts, will constitute a tale that future ages will find it difficult to understand. What are the sentiments in this respect that are alone worthy of a rational being? Give me that, and that only, which without injustice you cannot refuse. More than justice it would be disgraceful for me to ask, and for you to bestow. I stand upon the foundation of right. This is a title which brute force may refuse to acknowledge, but which all the force in the world cannot annihilate. By resisting this plea you may prove yourself unjust, but in yielding to it you grant me but my due. If, all things considered, I be the fit subject of a benefit, the benefit is merited: merit in any other sense is contradictory and absurd. If you bestow upon me unmerited advantage, you are a recreant from the general good. I may be base enough to thank you; but if I were virtuous, I should condemn you. These sentiments alone are consistent with true independence of mind. He that is accustomed to regard virtue as an affair of favour and grace, cannot be eminently virtuous. If he occasionally perform an action of apparent kindness, he will applaud the generosity of his sentiments; and if he abstain, he will acquit himself with the question, 'May I not do what I will with my own?' In the same manner, when he is treated benevolently by another, he will in the first place be unwilling to examine strictly into the reasonableness of this treatment, because benevolence, as he imagines, is not subject to any inflexibility of rule; and, in the second place, he will not regard his benefactor with that erect and unembarrassed mien, that complete sense of equality, which is the only immoveable basis of virtue and happiness."

Such is Mr Godwin's conclusion on this subject; and we leave it with our readers to determine, whether his system or that which we at present enjoy would be the more rigorous or unjust; or whether mankind have indeed arrived at that eminent pitch of virtue, as to disdain every favour which they do not absolutely merit. The Christian religion speaks a very different language.

PAREGORICS, in *Pharmacy*, medicines that assuage pain, otherwise called ANODYNES.

PAREIRA FLAVA, in the *Materia Medica*, a kind of oblong and large root brought from the Brasils.—It is certainly a diuretic of no mean character, and is said to have done great service in nephritic cases, pleurisies, and quinsies.

PARELCON, in *Grammar*, a figure by which a word or syllable is added to the end of another.

PAREMBOLE, in *Rhetoric*, a figure wherein something relating to the subject is inserted in the middle of a period. All the difference between the parembole and parenthesis, according to Vossius, is, that the former relates to the subject in hand, whereas the latter is foreign to it.

PARENCHYMA, in *Anatomy*, a term introduced by Erasistratus, signifying all that substance which is contained in the interstices betwixt the blood vessels of the viscera, which he imagined to be extravasated and concreted blood.

PARENCHYMA *of Plants*. Grew applies the term *parenchyma* to the pith or pulp, or that inner part of a fruit or plant through which the juice is supposed to be distributed. See PLANTS.

Parenchyma, Parent.

PARENT, a term of relation applicable to those from whom we immediately derive our being. See MORAL *Philosophy*, N° 129. and 137.

To this article belongs an inquiry into, 1. The legal duties of parents to their legitimate children. 2. Their power over them.

I. The duties of parents to legitimate children consist in three particulars; their *maintenance*, their *protection*, and their *education*.

Blackst Comment.

1. The duty of parents to provide for the *maintenance* of their children, is a principle of natural law; an obligation, says Puffendorff, laid on them not only by nature herself, but by their own proper act, in bringing them into the world; for they would be in the highest manner injurious to their issue, if they only gave their children life, that they might afterwards see them perish. By begetting them, therefore, they have entered into a voluntary obligation, to endeavour, as far as in them lies, that the life which they have bestowed shall be supported and preserved. And thus the children will have a perfect right of receiving maintenance from their parents. And the president Montesquieu has a very just observation upon this head, that the establishment of marriage, in all civilized states, is built on this natural obligation of the father to provide for his children; for that ascertains and makes known the person who is bound to fulfil this obligation; whereas, in promiscuous and illicit conjunctions, the father is unknown; and the mother finds a thousand obstacles in her way; shame, remorse, the constraint of her sex, and the rigour of laws, that stifle her inclinations to perform this duty; and besides, she generally wants ability.

The municipal laws of all well regulated states have taken care to enforce this duty: though Providence has done it more effectually than any laws, by implanting in the breast of every parent that natural στοργη, or insuperable degree of affection, which not even the deformity of person or mind, not even the wickedness, ingratitude, and rebellion of children, can totally suppress or extinguish.

The civil law obliges the parent to provide maintenance for his child; and if he refuse, *judex de ea re cognoscet*. Nay, it carries this matter so far, that it will not suffer a parent at his death totally to disinherit his child, without expressly giving his reason for so doing; and there are 14 such reasons reckoned up, which may justify such disinherison. If the parent alleged no reason, or a bad, or a false one, the child might set the will aside, *tanquam testamentum inofficiosum*, a testament contrary to the natural duty of the parent. And it is remarkable under what colour the children were to move for relief in such a case; by suggesting, that the parent had lost the use of his reason when he made the *inofficious* testament. And this, as Puffendorff observes, was not to bring into dispute the testator's power of disinheriting his own offspring; but to examine the motives upon which he did it; and if they were found defective in reason, then to set them aside. But perhaps this is going rather too far; every man has, or ought to have, by the laws of society, a power over his own property: and as Grotius very well distinguishes, natural right obliges to give a necessary

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cessary maintenance to children; but what is more than that, they have no right to, than as it is given by the favour of their parents, or the positive constitutions of the municipal law.

Let us next see what provision our own laws have made for this natural duty. It is a principle of law, that there is an obligation on every man to provide for those descended from his loins; and the manner in which this obligation shall be performed, is thus pointed out. The father and mother, grandfather and grandmother, of poor impotent persons, shall maintain them at their own charges, if of sufficient ability, according as the quarter sessions shall direct; and, if a parent runs away, and leaves his children, the church wardens and overseers of the parish shall seize his rents, goods, and chattels, and dispose of them towards their relief. By the interpretations which the courts of law have made upon these statutes, if a mother or grandmother marries again, and was before such second marriage of sufficient ability to keep the child, the husband shall be charged to maintain it; for this being a debt of her's, when single, shall, like others, extend to charge the husband. But, at her death, the relation being dissolved, the husband is under no farther obligation.

No person is bound to provide a maintenance for his issue, unless where the children are impotent and unable to work, either through infancy, disease, or accident; and then is only obliged to find them with necessaries, the penalty on refusal being no more than 20s. a month. For the policy of our laws, which are ever watchful to promote industry, did not mean to compel a father to maintain his idle and lazy children in ease and indolence; but thought it unjust to oblige the parent, against his will, to provide them with superfluities, and other indulgencies of fortune; imagining they might trust to the impulse of nature, if the children were deserving of such favours. Yet, as nothing is so apt to stifle the calls of nature as religious bigotry, it is enacted, that if any Popish parent shall refuse to allow his Protestant child a fitting maintenance, with a view to compel him to change his religion, the lord chancellor shall by order of court constrain him to do what is just and reasonable. But this did not extend to persons of another religion, of no less bitterness and bigotry than the Popish: and therefore, in the very next year, we find an instance of a Jew of immense riches, whose only daughter having embraced Christianity, he turned her out of doors; and on her application for relief, it was held she was entitled to none. But this gave occasion to another statute, which ordains, that if Jewish parents refuse to allow their Protestant children a fitting maintenance, suitable to the fortune of the parent, the lord chancellor, on complaint, may make such order therein as he shall see proper.

Our law has made no provision to prevent the disinheriting of children by will; leaving every man's property in his own disposal, upon a principle of liberty in this as well as every other action; though perhaps it had not been amiss if the parent had been bound to leave them at the least a necessary subsistence. Indeed, among persons of any rank or fortune, a competence is generally provided for younger children, and the bulk of the estate settled upon the eldest by the marriage articles. Heirs also, and children, are favourites of our courts of justice, and cannot be disinherited by any dubious or ambiguous words; there being required the utmost certainty of the testator's intentions to take away the right of an heir.

2. From the duty of maintenance we may easily pass to that of *protection*; which is also a natural duty, but rather permitted than enjoined by any municipal laws; nature, in this respect, working so strongly as to need rather a check than a spur. A parent may, by our laws, maintain and uphold his children in their law-suits, without being guilty of the legal crime of maintaining quarrels. A parent may also justify an assault and battery in defence of the persons of his children; nay, where a man's son was beaten by another boy, and the father went near a mile to find him, and there revenged his son's quarrel by beating the other boy, of which beating he afterwards unfortunately died; it was not held to be murder, but manslaughter merely. Such indulgence does the law show to the frailty of human nature, and the workings of parental affection.

3. The last duty of parents to their children is that of giving them an *education* suitable to their station in life: a duty pointed out by reason and of far the greatest importance of any. For, as Puffendorff very well observes, it is not easy to imagine or allow, that a parent has conferred any considerable benefit upon his child by bringing him into the world, if he afterwards entirely neglects his culture and education, and suffers him to grow up like a mere beast, to lead a life useless to others, and shameful to himself. Yet the municipal laws of most countries seem to be defective in this point, by not constraining the parent to bestow a proper education upon his children. Perhaps they thought it punishment enough to leave the parent who neglects the instruction of his family, to labour under those griefs and inconveniences which his family, so uninstructed, will be sure to bring upon him. Our laws, though their defects in this particular cannot be denied, have in one instance made a wise provision for breeding up the rising generation: since the poor and laborious part of the community, when past the age of nurture, are taken out of the hands of their parents, by the statutes for apprenticing poor children; and are placed out by the public in such a manner as may render their abilities, in their several stations, of the greatest advantage to the commonwealth. The rich indeed are left at their own option, whether they will breed up their children to be ornaments or disgraces to their family. Yet in one case, that of religion, they are under peculiar restrictions; for it is provided that if any person sends any child under his government beyond the seas, either to prevent its good education in England, or in order to enter into, or reside in, any Popish college, or to be instructed, persuaded, or strengthened in the Popish religion; in such case, besides the disabilities incurred by the child so sent, the parent or person sending shall forfeit 100l. which shall go to the sole use and benefit of him that shall discover the offence. And if any parent, or other, shall send or convey any person beyond sea, to enter into or be resident in, or trained up in, any priory, abbey, nunnery, Popish university, college or school, or house of Jesuits or priests, or in any private Popish family, in order to be instructed, persuaded or confirmed, in the

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Popish religion; or shall contribute any thing towards their maintenance when abroad by any pretext whatever, the person both sending and sent shall be disabled to sue in law or equity, or to be executor or administrator to any person, or to enjoy any legacy or deed of gift, or to bear any office in the realm, and shall forfeit all his goods and chattels, and likewise all his real estate for life. See NONCONFORMISTS.

II. The *power* of parents over their children is derived from the former consideration, their *duty*; this authority being given them, partly to enable the parent more effectually to perform his duty, and partly as a recompense for his care and trouble in the faithful discharge of it. And upon this score the municipal laws of some nations have given a much larger authority to the parents than others. The ancient Roman laws gave the father a power of life and death over his children; upon this principle, that he who gave had also the power of taking away. But the rigour of these laws was softened by subsequent constitutions: so that we find a father banished by the emperor Hadrian for killing his son, though he had committed a very heinous crime; upon this maxim, that *patris potestas in pietate debet, non in atrocitate, consistere.* But still they maintained to the last a very large and absolute authority: for a son could not acquire any property of his own during the life of his father; but all his acquisitions belonged to the father, or at least the profits of them for his life.

The power of a parent by the English law is much more moderate; but still sufficient to keep the child in order and obedience. He may lawfully correct his child, being under age, in a reasonable manner: for this is for the benefit of his education. The consent or concurrence of the parent to the marriage of his child under age, was also directed by our ancient law to be obtained: but now it is absolutely necessary; for without it the contract is void. And this also is another means which the law has put into the parent's hands, in order the better to discharge his duty; first, of protecting his children from the snares of artful and designing persons; and next of settling them properly in life, by preventing the ill consequences of too early and precipitate marriages. A father has no other power over his son's estate, than as his trustee or guardian: for though he may receive the profits during the child's minority, yet he must account for them when he comes of age. He may indeed have the benefit of his children's labour while they live with him and are maintained by him; but this is no more than he is entitled to from his apprentices or servants. The legal power of a father (for a mother, as such, is entitled to no power, but only to reverence and respect), the power of a father, we say, over the persons of his children ceases at the age of 21; for they are then enfranchised by arriving at years of discretion, or that point which the law has established (as some must necessarily be established) when the empire of the father, or other guardian, gives place to the empire of reason. Yet, till that age arrives, this empire of the father continues even after his death; for he may by his will appoint a guardian to his children. He may also delegate part of his parental authority, during his life, to the tutor or schoolmaster of his child; who is then *in loco parentis*, and has such a portion of the power of the parent committed to his charge, viz. that of restraint and correction, as may be necessary to answer the purposes for which he is employed.

In the Gentleman's Magazine for 1750, we have the following case of conscience. "A person has his own parents and his own children living, both parties equally indigent, both equally incapable of assisting themselves, and both equally earnest in calling upon him for relief. Things are so circumstanced that he can possibly assist but one party, and not both. *Query*, Which party has the greatest claim to his assistance, and to which is he obliged, by all ties human and divine, to give the preference?" One solves this difficulty, by informing us of a pretty print done at Rome, representing a young woman suckling her aged father, on which the following lines are quoted.

> My child and father vital nurture crave,
> Parental, filial, fondness both would save,
> But if a nursling only one can live,
> I choose to save the life I cannot give.

Here we find the preference given to the parent; and another correspondent gives the same decision in these words. "The obligations arising from nature, and natural affection, seem to be in this case reciprocal and equipollent; the child is as strongly attracted to the parent, as the parent to the child. But will not filial gratitude operate and decide in favour of the parents? Does not the person, either mediately or immediately, owe his present power and abilities to relieve, to his parents? and are they not on that account best entitled to relief? Does not the fifth commandment declare more strongly in favour of the parents, than any other divine precept does in favour of the children? If a person had an opportunity given him of delivering either his parent or his child (but not both) from certain death, I dare say the voice of nature and of mankind would applaud him that saved his parent, and condemn him that should prefer his child. There is more of selfishness in preferring the child; and to save the parent seems to me to be much the more generous, noble and exalted conduct. It is indeed, upon the whole, a melancholy alternative; but if both parties continue importunate, and neither will relinquish their claims in favour of the other, I say relieve the parent." There are two correspondents, however, who think differently, and their reasons are as follows: "A person's children have the greatest claim to his assistance, and he is obliged by all ties to prefer them, in that respect, to his parents. It is true, when a man's parents are in want, they have a claim to his assistance; but that claim is not equal to that which his children have. His parents he has of necessity; his children, of choice. It is his duty before he beget children, to consider how he is to provide for them: and by being wilfully the cause of their existence, he comes under such an obligation to provide for their comfortable subsistence, as must be stronger than any obligation of that kind he can be under to persons with whom his connexion is involuntary. But nature and reason point it out as the duty of all parents to provide for their children; but not *vice versa.* If a man's parents happen to be indigent, and he himself able, he is bound to maintain them out of respect and gratitude: but his obligation to provide for his children is is a debt of strict justice; and therefore ought to be preferred. Nevertheless the description of the case to which the query is subjoined, is so general, that it is easy to figure a case according to that description in which the person ought to prefer his parents. This obligation to provide for his children may have been dissolved by monstrous ingratitude, such as their plotting against his life; or he may have given them proper education, and ample provisions, which they have riotously squandered away: in either of which cases it is thought he is undoubtedly discharged from his obligation. But if they have lost their portion purely by misfortunes, without their fault, it is thought his obligation to assist them is not wholly extinguished; and in that case their claim to his assistance, or that of his parents, is preferable." "I find (says the author of the last answer) that all your correspondents agree, that the life of the parents is to be preserved. It is very certain, that the relation between me and my child is exactly equal to that which is between me and my parent; and therefore relation cannot decide in favour of the one or the other: I must then be determined by a different consideration; and I know of none more weighty than the following: If I preserve the life of my child, I am instrumental in giving life to all his descendants, which may, perhaps, be very numerous; but if I preserve the life of my parent, I preserve a single life only, and that a short one. I therefore say, *relieve the child*. But it is thought that the voice of nature will applaud the person who preserves the parent: if so, nature must applaud a rule which she herself does not observe: it is natural for old men to die before young ones. Besides, the command, *Be fruitful and multiply, and replenish the earth*, may be opposed to the fifth commandment." Still, however, it is doubtless difficult to determine in such cases when they occur, as there are no fixed rules whereby to decide. With respect to the power of parents and the duty of children, much may be said. There are, however, scarcely any instances where both are oftener abused than with respect to marriage. This, as it is the most important event in the civil life either of a man or woman, so it is often rendered peculiarly unfortunate, by precipitate folly and want of duty in children; and as often through the unreasonable severity of parents. As a child is bound not to give unreasonable offence to a parent in the choice of a partner; so neither ought the parent to impose any improper or arbitrary restraint upon the child.

The power of a parent in China is very great; for a father, while living, has the power of an absolute despotic tyrant, and after his death is worshipped as a god. Let a son become ever so rich, and a father ever so poor, there is no submission, no point of obedience, that the latter cannot command, or that the former can refuse. The father is absolute master, not only of his son's estate, but also of his concubines and children, who, whenever they displease him, he may sell to strangers. If a father accuses his son before a mandarin, there needs no proof of his guilt; for they cannot believe that any father can be so unnatural as to bring a false accusation against his own son. But should a son be so insolent as to mock his father, or arrive at such a pitch of wickedness as to strike him, all the province where this shameful act of violence is committed is alarmed; it even becomes the concern of the whole empire; the emperor himself judges the criminal. All the mandarins near the place are turned out of their posts, especially those of the town where he lived, for having been so negligent in their instructions; and all the neighbours are reprimanded for neglecting, by former punishments, to put a stop to the wickedness of the criminal before it arrived at such flagitiousness. As to the unhappy wretch himself, they cut him into a thousand pieces, burn his bones, level his house to the ground, and even those houses that stand near it, and set up monuments and memorials of the horrid deed.

The emperor of China, who is one of the most powerful and despotic monarchs upon earth, pays the greatest attention to his mother. An instance of this Pere Amyot relates as having happened at Pekin, A. D. 1752, when the emperor's mother entered her 60th year, which, among the Chinese, is accounted a very remarkable period. Grosier likewise particularly describes the homage the emperor pays his mother every new-year's day in the palace, at which ceremony all the great officers of his court assist. See CHILDREN, *Filial Piety*, PARENTAL *Affection*, &c.

PARENT, *Anthony*, a mathematician, was born at Paris in 1666. He showed an early propensity to mathematics. He accustomed himself to write remarks upon the margins of the books which he read; and he had filled a variety of books with a kind of commentary at the early age of thirteen. At fourteen he was put under a master, who taught rhetoric at Chartres. It was here that he happened to see a dodecaedron, upon every face of which was delineated a sun dial, except the lowest whereon it stood. Struck as it were instantaneously with the curiosity of these dials, he attempted drawing one himself: but having a book which only showed the practical part without the theory, it was not till after his master came to explain the doctrine of the sphere to him that he began to understand how the projection of the circles of the sphere formed sun dials. He then undertook to write a Treatise upon Gnomonics. The piece was indeed rude and unpolished; but it was entirely his own, and not borrowed. About the same time he wrote a book of Geometry, in the same taste, at Beauvois. His friends then sent for him to Paris to study the law; and, in obedience to them, he studied a course in that faculty; which was no sooner finished, than, urged by his passion for mathematics, he shut himself up in the college of Dormans, that no avocation might take him from his beloved study: and, with an allowance of less than 200 livres a-year, he lived content in this retreat, from which he never stirred but to the Royal College, in order to hear the lectures of M. de la Hire or M. Sauveur. When he found himself capable of teaching others, he took pupils: and fortification being a branch of mathematics which the war had brought into particular notice, he turned his attention to it; but after some time began to entertain scruples about teaching what he had never seen, and knew only by the force of imagination. He imparted this scruple to M. Sauveur, who recommended him to the marquis d'Aligre, who luckily at that time wanted to have a mathematician with him. Parent made two campaigns with the marquis, by which he he instructed himself sufficiently in viewing fortified places; of which he drew a number of plans, though he had never learned the art of drawing. From this period he spent his time in a continual application to the study of natural philosophy, and mathematics in all its branches, both speculative and practical; to which he joined anatomy, botany, and chemistry. His genius managed every thing, and yet he was incessant and indefatigable in his application. M. de Billettes, who was admitted into the Academy of Sciences at Paris in 1699, with the title of their mechanician, nominated for his disciple Parent, who excelled chiefly in this branch. It was soon discovered in this society, that he engaged in all the various subjects which were brought before them; and indeed that he had a hand in every thing. But this extent of knowledge, joined to a natural impetuosity of temper, raised in him a spirit of contradiction, which he indulged on all occasions; sometimes to a degree of precipitancy highly culpable, and often with but little regard to decency. Indeed the same behaviour was shown to him, and the papers which he brought to the academy were often treated with much severity. He was charged with obscurity in his productions; and he was indeed so notorious for this fault, that he perceived it himself, and could not avoid correcting it. The king had, by a regulation in 1716, suppressed the class of scholars of the academy, which seemed to put too great an inequality betwixt the members. Parent was made a joint or assistant member for geometry: but he enjoyed this promotion but a short time; for he was taken off by the small-pox the same year, at the age of 50. He was author of a great many pieces, chiefly on mechanics and geometry.

PARENTAL, something belonging to the relation of parent. See PARENT.

PARENTAL Affection, the endearing attachment of parents to their children, including in it love; a desire of doing good to those who by an act of our own depend upon us for all that they enjoy. Nature even excites this affection in brutes: but in them it continues only so long as it is necessary for the preservation of their offspring; for when these are able to provide for themselves, it ceases, and the relation is forgotten. In man, however, though it lessens, or at least becomes less anxious as the dependence of the child becomes less, it never entirely ceases, except in some few instances of extreme depravity. Authors, however, have imagined, and Lord Kames* among the rest, that after the child is provided for, and no more depends on the parent, all affection would cease, were it not artificially preserved and confirmed by habit. Whether his lordship, in this opinion, be right or wrong, we shall not pretend to say. One thing, however, is certain, that be it natural or not, it is one of the greatest comforts of life, even when all dependence has ceased. It matters not that there are many instances where this comfort is not felt. Human depravity has often obliterated the finest feelings of the mind; and it is not to be wondered at if in some instances it do so in the case before us. A good heart certainly can enjoy no greater satisfaction than that arising from grateful returns of kindness and affection to an aged parent. As the vexations which parents receive from their children hasten the approach of age, and double the force of years; so the comforts which they reap from them are balm to all other sorrows, and disappoint the injuries of time. Parents repeat their lives in their offsprings; and their concern for them is so near, that they feel all their sufferings, and taste all their enjoyments, as much as if they regarded their own persons. However strong we may suppose the fondness of a father for his children, yet they will find more lively marks of tenderness in the bosom of a mother. There are no ties in nature to compare with those which unite an affectionate mother to her children, when they repay her tenderness with obedience and love.

* *Sketches of the History of Man.*

We have a remarkable instance of parental affection in Zaleucus † prince of the Locrines; who made a decree, that whoever was convicted of adultery should be punished with the loss of both his eyes. Soon after this establishment, the legislator's own son was apprehended in the very fact, and brought to a public trial. How could the father acquit himself in so tender and delicate a conjuncture? Should he execute the law in all its rigour, this would be worse than death to the unhappy youth: should he pardon so notorious a delinquent, this would defeat the design of his salutary institution. To avoid both these inconveniences, he ordered one of his own eyes to be pulled out and one of his son's.

† *Ælian*, lib. xiii.

Diodorus Siculus also, lib. 34. relates a surprising instance of the same warm affection. Cambalus, a young gentleman of character and fortune in the city of Mulgeatum, being one day out coursing, was way-laid, and very near being robbed and murdered by the banditti who infested that part of the country. Gorgus, the young gentleman's father, happened to come by at the very instant, to whom Cambalus related the danger he was in. The son was on foot, the father on horseback; but no sooner had he heard the melancholy tale, than he leapt from his horse, desired his son to mount, and make the best of his way into the city: but Cambalus, preferring his father's safety to his own, would by no means consent to it; on the contrary, conjured his father to leave him, and take care of himself. The father, struck with the generosity and affection of his son, added tears to entreaties, but all to no purpose. The contest between them is better conceived than described —while bathed in tears, and beseeching each other to preserve his own life, the banditti approached and stabbed them both.

Amongst the ancient Greeks, the sentiments of parental affection were exceedingly strong and ardent. The mutual tenderness of the husband and the wife was communicated to their offspring; while the father viewed in his child the charms of its mother, and the mother perceived in it the manly graces of its father. As parental kindness is the most simple and natural expansion of self-love, so there are innumerable instances of it in all countries savage and civilized.

PARENTALIA, in antiquity, funeral obsequies, or the last duties paid by children to their deceased parents.

PARENTHESIS, in *Grammar*, certain intercalary words inserted in a discourse, which interrupt the sense or thread, but seem necessary for the better understanding of the subject.

PARENZO, a small but strong town of Italy, and in Istria, with a bishop's see and a good harbour; seated ed on the gulf of Venice, in E. Long. 13. 46. N. Lat. 39. 28. It submitted to the Venetians in 1267.

PARESIS, in *Medicine*, a palsy of the bladder wherein the urine is either suppressed or discharged involuntarily.

PARGETING, in building, is used for the plastering of walls, and sometimes for plaster itself.

Pargeting is of various kinds: as, 1. White lime and hair mortar laid on bare walls. 2. On bare laths, as in partitioning and plain ceiling. 3. Rendering the insides of walls, or doubling partition walls. 4. Rough-casting on heart laths. 5. Plastering on brick work, with finishing mortar, in imitation of stone work; and the like upon heart laths.

PARHELION, or PARHELIUM, formed from παρα, *near*, and ἡλιος, *sun*, in *Natural Philosophy*, a mock sun or meteor, in form of a very bright light, appearing on the one side of the sun.

Appearances of this kind have been made mention of both by the ancients and moderns. Aristotle observes, that in general they are seen only when the sun is near the horizon, though he takes notice of two that were seen in Bosphorus from morning to evening; and Pliny has related the times when such phenomena were observed at Rome. Gassendi says, that in 1635 and 1636 he often saw one mock sun. Two were observed by M. de la Hire in 1689; and the same number by Cassini in 1693, Mr Grey in 1700, and Dr Halley in 1702: but the most celebrated appearances of this kind were seen at Rome by Scheiner, by Muschenbroeck at Utrecht, and by Hevelius at Sedan. By the two former, four mock suns were observed, and by the latter seven.

Parhelia are apparently of the same size with the sun, though not always of the same brightness, nor even of the same shape; and when a number appear at once, there is some difference in both these respects among them. Externally they are tinged with colours like the rainbow; and many have a long fiery tail opposite to the sun, but paler towards the extremity. Parhelia are generally accompanied with coronas, some of which are tinged with rainbow colours, but others are white. They differ in number and size; but all agree in breadth, which is that of the apparent diameter of the sun.

A very large white circle, parallel to the horizon, generally passes through all the parhelia; and, if it were entire, it would go through the centre of the sun. Sometimes there are arcs of lesser circles concentric to this, touching those coloured circles which surround the sun. They are also tinged with colours, and contain other parhelia. There are also said to have been other circles obliquely situated with respect to all those we have mentioned; but of this we have met with no authentic account. The order of the colours in these circles is the same as in the rainbow; but on the inside, with respect to the sun, they are red, as is also observed in many other coronas.

Parhelia have been visible for 1, 2, 3, and 4 hours together; and in North America, they are said to continue some days, and to be visible from sunrise to sunset.

When the parhelia disappear, it sometimes rains, or there falls snow in the form of oblong spiculæ, as Maraldi, Weidler, Krafft, and others, have observed; and because the air in North America abounds with such frozen spiculæ, which are even visible to the eye, according to Ellis and Middleton, such particles have been thought to be the cause of all coronas and parhelia.

Mr Ellis says, that, at Churchill in Hudson's Bay, the rising of the sun is always preceded by two long streams of red light, one on each side of him, and about 20° distant from him. These rise as the sun rises; and as they grow longer begin to bend towards each other, till they meet directly over the sun, just as he rises, forming there a kind of parhelion or mock sun. These two streams of light, he says, seem to have their source in two other parhelia, which rise with the true sun; and in the winter season, when the sun never rises above the haze or fog, which he says is constantly found near the horizon, all these accompany him the whole day, and set with him in the same manner as they rise. Once or twice he saw a fourth parhelion directly under the true sun; but this, he says, is not common. These facts being constant, are very valuable, and may throw great light on the theory of these remarkable phenomena.

Sometimes parhelia appear in a different manner; as when three suns have been seen in the same vertical circle, well defined, and touching one another. The true sun was in the middle, and the lowest touched the horizon; and they set one after the other. This appearance was seen by M. Maleziew in 1722. Other appearances similar to this are recited by M. Muschenbroeck.

Sometimes the sun has risen or set with a luminous tail projecting from him, of the same breadth with his diameter, and perpendicular to the horizon. Such an appearance was seen by Cassini in 1672 and 1692, by De la Hire in 1702, and by Mr Ellis in Hudson's Bay.

As M. Feuillée was walking on the banks of the river La Plata, he saw the sun rising over the river with a luminous tail projecting downwards, which continued till he was six degrees high.

Paraselenæ, or mock moons, have also been seen, accompanied with tails and coloured circles, like those which accompany the parhelia. An account of several, and a particular description of a fine appearance of this kind, may be seen in Muschenbroeck.

The Roman phenomenon, observed by Scheiner, is famous on account of its having been the first appearance of the kind that engaged the attention of philosophers. It is represented in fig. 1.; in which A is the place of the observer, B his zenith, C the true sun, AB a plane passing through the observer's eye, the true sun, and the zenith. About the sun C, there appeared two concentric rings, not complete, but diversified with colours. The lesser of them, DEF, was fuller, and more perfect; and though it was open from D to F, yet those ends were perpetually endeavouring to unite; and sometimes they did so. The outer of these rings was much fainter, so as scarcely to be discernible. It had, however, a variety of colours; but was very inconstant. The third circle, KLMN, was very large, and all over white, passing through the middle of the sun, and every where parallel to the horizon. At first this circle was entire; but towards the end of the appearance it was weak and ragged, so as hardly to be perceived from M towards N.

Plate CCCCIV. fig. 1.

Parhelion.

In the intersection of this circle, and the outward iris GKI, there broke out two parhelia or mock suns N and K, not quite perfect; K being rather weak, but N shone brighter and stronger. The brightness of the middle of them was something like that of the sun; but towards the edges they were tinged with colours like those of the rainbow; and they were uneven and ragged. The parhelion N was a little wavering, and sent out a spiked tail, NP, of a colour somewhat fiery, the length of which was continually changing.

The parhelia at L and M in the horizontal ring were not so bright as the former; but were rounder, and white, like the circle in which they were placed. The parhelion N disappeared before K; and while M grew fainter, K grew brighter, and varnished the last of all.

It is to be observed farther, that the order of the colours in the circles DEF, GKN, was the same as in the common halos, namely, red next the sun; and the diameter of the third circle was also about 45 degrees; which is the usual size of a halo.

The reverend Dr Hamilton sent the following account of parhelia, seen at Cookstown, to the Royal Irish Academy.

"Wednesday, September 24th, 1783, as I was preparing to observe the sun passing the meridian, before the first limb touched the centre wire, it was obscured by a dark well defined cloud, about 10° in diameter. Upon going to the door of the transit room, to see if it was likely soon to pass off the disk of the sun, I observed the following phenomena: From the western edge of the cloud issued a luminous arc parallel to the horizon, perfectly well defined, extending exactly to the northern meridian; it was about 30′ broad, white, and ended in a blunted termination. On it were two parhelia; the nearest to the sun displaying the prismatic colours; the remote one white, and both ill defined. In a short time the cloud had passed off, and showed the luminous almucantar, reaching perfect to the true sun. While things were thus situated, I measured with an accurate sextant the distances of the parhelia; I found the coloured one 26°, the remoter one 90°, from the true sun. Just as I had done this, a new and prismatic circle surrounded the sun immediately with the prismatic parhelion. And now another coloured parhelion appeared on the eastern board.—The sextant with its face up and down, exactly measured this and the former at the original distance of 26°; the luminous almucantar still remaining perfect. In about 10 or 12 minutes whitish hazy clouds came on, and obscured all these uncommon appearances.—I did not observe that the atmospherical phenomena before or after were at all uncommon. The wind a light breeze at SSW. Bar. 29. 6. rising. Thermometer 55°.

Fig. 2.

In fig. 2. SM represents the south meridian; NM the north meridian; PP the prismatic circle, with two prismatic suns or parhelia, at 26° distance on each side the true sun; W the white parhelion, at 90° distance from the true sun; LA the luminous almucantar; and HO the horizon.

Various hypotheses have been framed by philosophers to account for this phenomenon, particularly by M. Marriotte, Descartes, and Huygens. None of them, however, are satisfactory: but those readers who wish to become acquainted with them may consult Huygens's Dissertation on this subject, in Smith's Optics, book i. chap. xi. Muschenbroeck's Introduction, &c. vol. xi. p. 1038, &c. 4to.; but especially Dr Priestley's History of Vision, Light, and Colours, vol. ii. p. 613, &c.

Parhelion ‖ Paria.

PARIA, or **New Andalusia**, a country of Terra Firma in South America; bounded on the north by the North sea; on the east by Surinam; on the west by New Granada and the Caraccas; and on the south by Guiana. It produces colouring drugs, gums, medicinal roots, Brazil wood, sugar, tobacco, and some valuable timber; the inland parts being woody and mountainous, but interspersed with fine valleys that yield corn and pasturage. Comana is the capital town.

PARIAN Chronicle. See *Arundelian Marbles*, and *Parian Chronicle*.

Under the article *Parian Chronicle*, we have been as full as the subject seemed to require, or as the nature of our work would admit. It is unnecessary, therefore, to resume it in this place. Such of our readers, however, as wish for further information on this subject (which is equally interesting to the scholar and to the antiquarian) we must refer to Robertson's attack upon their authenticity, and to Gough's learned and judicious vindication of the authenticity, published in *Archæologia* for 1789. The extent of his learning, and the solidity of his arguments, appear upon the whole to outweigh the objections of his sensible and plausible opponent. Hewlett's book upon the same side of the question may command some degree of attention. It is ingenious. See *Sandwich Marble*.

Parian Marble, among the ancients, the white marble used by them, and to this day, for carving statues, &c. and called by us at this time *statuary marble*.

Too many of the later writers have confounded all the white marbles under the name of the *Parian*; and among the workmen, this and all the other white marbles have the common name of *alabasters*; so that it is in general forgotten among them, that there is such a thing as alabaster different from marble; which, however, is truly the case. Almost all the world also have confounded the Carrara marble with this, though they are really very different; the Carrara kind being of a finer texture and clearer white than the Parian; but less bright and splendid, harder to cut, and not capable of so glittering a polish.

The true Parian marble has usually somewhat of a faint bluish tinge among the white, and often has blue veins in different parts of it. It is supposed by some to have had its name from the island Paros †, one of the Cyclades in the Ægean sea, where it was first found; but others will have it to have been so called from Agoracritus Parius, a famous statuary, who ennobled it by cutting a statue of Venus in it.

† See *Paros*.

PARIAS, or **Perreas**, a tribe of Hindoos, so peculiarly distinguished from all others, that they live by themselves in the outskirts of towns; and, in the country, build their houses apart from the villages, or rather have villages of their own, furnished with wells; for they dare not so much as fetch water from those which other families make use of; and, lest these latter should inadvertently go to one of theirs, they are obliged to scatter the bones of dead cattle about their wells, that they may be known. They dare not in cities pass through

Mod. Univ. Hist. v. 6.

through the streets where the Bramins live; nor set foot in the villages where they dwell.—They are likewise forbidden to enter a temple, either of their god Wistnow or Eswara; because they are held impure. They get their bread by sowing, digging, and building the walls of mud houses; most of these inhabited by the common people being raised by these Parias; who also do such kinds of dirty work as other people do not care to meddle with. Nor is their diet much more cleanly; for they do not scruple to eat cows, horses, fowl, or other carrion, which die of themselves, and are even putrid. One would scarce imagine, that contentions for precedency should ever enter into the thoughts of a people who have renounced all cleanliness, and, like swine, wallow in filth; and yet pride has divided the Parias into two classes: the first are simply called *Parias*, the other *Seriperes*. The employment of these latter is to go about selling leather, which they dress; also to make bridles, and such kind of things: some of them likewise serve for soldiers. The Parias, who reckon themselves the better family, will not eat in the house of the Seriperes; but the Seriperes will readily eat with the Parias. For this reason they are obliged to pay them respect, by lifting their hands aloft, and standing upright before them. These Seriperes, when they marry, cannot set up a pandel, a kind of garland, before their doors, made with more than three stakes or trees; should they exceed that number, the whole city would be in motion. The Seriperes are likewise subject to some sort of slavery; for when any person of credit or authority dies in the families of the Komitis, Sittis, Palis, farriers, or goldsmiths, and the friends have a mind to be at the expence of some clothes to give the Seriperes, these latter must suffer their beards to be shaven; and when the corpse is carried out of town to be burned or interred, they must do that office; for which each receives a *fanum*, or one piece and a half of silver, worth three sous and a half. These are the same sort of people who are called at Surat *Halalchors*; that is, in the Persian language, "eat-alls, or eaters at large." Nothing can offend an Hindoo more than to be called a Halalchor: yet these poor people are not offended, cringe and bow to all they pass, and go through their drudgery without noise or concern.

The Parias are very vicious, stupid, and ignorant, occasioned by their wretched way of life: The Bramins and nobility shun them as if they had the plague, and look on the meeting a Parias as the greatest misfortune. To come near one of them is a sin, to touch them a sacrilege. If a Parias were dying, it is infamy to visit him, or to give him the least assistance, in the utmost danger or distress. A Bramin who unavoidably should touch a Parias, immediately washes himself from the impurity. Even their shadow and breath being reckoned contagious, they are obliged to live on the east side of their towns, that the westerly winds which prevail in this country may keep back their breath. And it is lawful for a Bramin to kill one of these unhappy creatures, if he does not avoid it by getting out of his way: In short, they think them reprobated by God, and believe the souls of the damned enter into the Parias, to be punished for their crimes.—Yet the mission have found among these dregs of the people very active zealous catechists, who by their labours have very much contributed to the conversion of their countrymen, particularly one Rajanaiken a Paria soldier, who, of all the inferior missionaries, has distinguished himself most by his labours and sufferings.

PARIETALIA OSSA. See ANATOMY *Index*.

PARIETARIA, *PELLITORY of the WALL*: A genus of plants belonging to the polygamia class; and in the natural method ranking under the 53d order, *Scabridæ*. See BOTANY *Index*.

PARIETES, in *Anatomy*, a term used for the enclosures or membranes that stop up or close the hollow parts of the body; especially those of the heart, the thorax, &c. The parietes of the two ventricles of the heart are of unequal strength and thickness; the left exceeding the right, because of its office, which is to force the blood through all parts of the body; whereas the right only drives it through the lungs.

PARIS, MATTHEW, one of our best historians from William the Conqueror to the latter end of the reign of Henry III. but of his life few particulars have been transmitted to us. Leland his original biographer, without determining whether he was born in France or England, informs us, that he was a monk of St Alban's, and that he was sent by Pope Innocent to reform the monks of the convent at Holm in Norway. Bishop Bale, the next in point of time, adds to the above relation, that, on account of his extraordinary gifts of body and mind, he was much esteemed, particularly by King Henry III. who commanded him to write the history of his reign. Fuller makes him a native of Cambridgeshire, because there was an ancient family of his name in that county. He also mentions his being sent by the pope to visit the monks in the diocese of Norwich. Bishop Tanner, Bishop Nicholson, Doctor Du Pin, and the *Nouveau Dictionnaire Historique*, add not a single fact to those above related. Matthew Paris died in the monastery of St Alban's in the year 1259. He was doubtless a man of extraordinary knowledge for the 13th century; of an excellent moral character, and, as an historian, of strict integrity. His style is unpolished; but that defect is sufficiently atoned for by the honest freedom with which he relates the truth, regardless of the dignity or sanctity of the persons concerned. His works are, 1. *Historia ab Adamo ad Conquestum Angliæ*, Lib. I. manuscript, col. C. C. Cantab. c. ix. Most of this book is transcribed, by Matthew of Westminster, into the first part of his *Florilegium*. 2. *Historia major, seu rerum Anglicanarum historia à Gul. Conquestoris adventu ad annum* 43 *Henrici* III. &c. several times printed. The first part of this history, viz. to the year 1235, is transcribed almost verbatim from the Chronicle of Roger Wendover; and the Appendix, from the year 1260, is the work of William Rashinger, who was also a monk of St Alban's. 3. *Vitæ duorum Offarum, Merciæ regum, S. Albani fundatorum*. 4. *Gesta* 22 *abbatum S. Albani*. 5. *Additamenta chronicorum ad hist. majorem*; printed. 6. *Historia minor, sive epitome majoris historiæ*; manuscript. Besides many other things in manuscript.

PARIS, son of Priam, king of Troy, by Hecuba, also named *Alexander*. He was decreed, even before his birth, to become the ruin of his country; and when his mother, in the first months of her pregnancy, had dreamed that she should bring forth a torch which would set fire to her palace, the soothsayers foretold the calamities which were to be expected from the imprudence of her future

Paris. future son, and which would end in the ruin of Troy. Priam, to prevent so great and so alarming an evil, ordered his slave Archelaus to destroy the child as soon as he was born. The slave, either touched with humanity, or influenced by Hecuba, did not obey, but was satisfied to expose the child on Mount Ida, where the shepherds of the place found him, and educated him as their own. Some attribute the preservation of his life, before he was found by the shepherds, to the motherly tenderness of a she-bear who suckled him. Young Paris, though educated among shepherds and peasants, gave very early proofs of courage and intrepidity; and from his care in protecting the flocks of Mount Ida from the rapacity of the wild beasts, he was named *Alexander*, "helper or defender." He gained the esteem of all the shepherds; and his graceful countenance and manly deportment recommended him to the favours of Oenone, a nymph of Ida, whom he married, and with whom he lived with the most perfect tenderness. Their conjugal peace was, however, of no long duration. At the marriage of Peleus and Thetis, the goddess of discord, who had not been invited to partake of the entertainment, showed her displeasure, by throwing into the assembly of the gods who were at the celebration of the nuptials, a golden apple, on which were written the words *Detur pulchriori*. All the goddesses claimed it as their own; the contention at first became general; but at last only three, Juno, Venus, and Minerva, wished to dispute their respective right to beauty. The gods, unwilling to become arbiters in an affair so tender and so delicate in its nature, appointed Paris to adjudge the prize of beauty to the fairest of the goddesses; and indeed the shepherd seemed sufficiently qualified to decide so great a contest, as his wisdom was so well established, and his prudence and sagacity so well known. The goddesses appeared before their judge without any covering or ornament, and each endeavoured by promises and entreaties to gain the attention of Paris, and to influence his judgment. Juno promised him a kingdom; Minerva military glory; and Venus the fairest woman in the world for his wife, as Ovid expresses it, *Hesiod* 17. v. 118.

Unaque cum regnum; belli daret altera laudem;
Tyndaridis conjux, tertia dixit, eris.

After he had heard their several claims and promises, Paris adjudged the prize to Venus, and gave her the golden apple, to which perhaps she seemed entitled as the goddess of beauty. This decision of Paris drew upon the judge and his family the resentment of the two other goddesses. Soon after, Priam proposed a contest among his sons and other princes, and promised to reward the conqueror with one of the finest bulls of Mount Ida. His emissaries were sent to procure the animal, and it was found in the possession of Paris, who reluctantly yielded it. The shepherd was anxious to regain his favourite, and he went to Troy and entered the lists of the combatants. He was received with the greatest applause, and obtained the victory over his rivals, Nestor the son of Neleus, Cycnus son of Neptune, Polites, Helenus, and Deiphobus, sons of Priam. He likewise obtained a superiority over Hector himself; which prince, enraged to see himself conquered by an unknown stranger, pursued him closely; and Paris must have fallen a victim to his brother's rage, had he not fled to the altar of Jupiter. This sacred retreat preserved his life; and Cassandra the daughter of Priam, struck with the similarity of the features of Paris with those of her brothers, inquired his birth and age. From these circumstances she soon discovered that he was her brother, and as such she introduced him to her father and to her brothers. Priam acknowledged Paris as his son, forgetful of the alarming dreams which had caused him to meditate his death, and all jealousy ceased among the brothers. Paris did not long suffer himself to remain inactive; he equipped a fleet, as if willing to redeem Hesione his father's sister, whom Hercules had carried away and obliged to marry Telamon the son of Æacus. This was the pretended motive of his voyage, but the causes were far different. Paris remembered that he was to be the husband of the fairest of women; and, if he had been led to form those expectations while he was an obscure shepherd of Ida, he had now every plausible reason to see them realized, since he was the acknowledged son of the king of Troy. Helen was the fairest woman of the age, and Venus had promised her to him. On these grounds, therefore, he went to Sparta, the residence of Helen, who had married Menelaus. He was received with great respect; but he abused the hospitality of Menelaus, and while the husband was absent in Crete, Paris persuaded Helen to elope with him, and to fly to Asia. Helen consented; and Priam received her into his palace without difficulty, as his sister was then detained in a foreign country, and as he wished to show himself as hostile as possible to the Greeks. This affair was soon productive of serious consequences. When Menelaus had married Helen, all her suitors had bound themselves by a solemn oath to protect her person, and therefore the injured husband reminded them of their engagements, and called upon them to recover her. Upon this all Greece took up arms in the cause of Menelaus; Agamemnon was chosen general of all the combined forces, and a regular war was begun. Paris, meanwhile, who had refused Helen to the petitions and embassies of the Greeks, armed himself, with his brothers and subjects, to oppose the enemy; but the success of the war was neither hindered nor accelerated by his means. He fought with little courage, and at the very sight of Menelaus, whom he had so recently injured, all his resolution vanished, and he retired from the front of the army, where he walked before like a conqueror. In a combat with Menelaus, which he undertook by means of his brother Hector, Paris must have perished, had not Venus interfered, and stolen him from the resentment of his antagonist. He wounded, however, in another battle, Machaon, Euryphilus, and Diomedes; and, according to some opinions, he killed with one of his arrows the great Achilles.

The death of Paris is differently related: some say that he was mortally wounded by one of the arrows of Philoctetes, which had been once in the possession of Hercules; and that when he found himself languid on account of his wounds, he ordered himself to be carried to the feet of Oenone, whom he had basely abandoned, and who in the years of his obscurity had foretold him that he would solicit her assistance in his dying moments. He expired before he came into the presence of Oenone; and the nymph, still mindful of their former loves, threw herself upon his body, and stabbed herself to the heart, after she had plentifully bathed it with her tears. According to others, Paris did not immediately go to Troy

Paris.

Troy when he left the Peloponnesus, but he was driven on the coasts of Egypt, where Proteus, who was king of the country, detained him; and when he heard of the violence which had been offered to the king of Sparta, he kept Helen at his court, and permitted Paris to retire. Whatever was the mode of his death, it took place, we are told, about 1188 B. C. See TROY, &c.

PARIS, the capital of the kingdom of France, is situated on the river Seine, in the department of the Seine, at the distance of 120 miles from the sea, and is one of the largest and finest cities in Europe. It derived its modern name from the ancient Parisii; and is supposed by some to have had the Latin name of *Lutetia*, from *lutum*, "mud," the place where it now stands having been anciently very marshy and muddy. Ever since the reign of Hugh Capet, that is, for near 800 years, this city has been the usual residence of the kings of France. It is of a circular form; its extent along the river is about four miles and a half, its breadth three and a half, and its circumference about 16 miles. The number of its inhabitants in 1817, was 713,000. Paris is the see of an archbishop, the seat of the court, of the chief tribunals, and public bodies in the kingdom. Before the revolution, it contained 46 parish churches, 20 subsidiary churches, 11 abbeys, 133 monasteries and convents, 13 colleges, 15 public schools, and 26 hospitals. Of the convents and monasteries, the greater number were suppressed in the course of the revolution. Three have been converted into commodious prisons, four into hospitals, three into barracks, and several others into markets and manufactories of various kinds. The Seine, upon which Paris stands, is much smaller than the Thames. It forms two islands, the Isle of St Louis, and the Isle of Notre Dame. The former was the site of the ancient city. In the oldest part of Paris, as in London, the streets are narrow, dark, and dirty. Few of them have pavements for foot passengers, who are exposed to be trodden down or crushed by the carriages plying back and forward. The gutter, which is in the centre, is generally filled with a stream of mud even in summer, which the pedestrian often finds it difficult to cross, and from which he is sure to be bespattered by the drivers of the cabriolets. There are few of those splendid equipages which crowd the streets of London to be seen in Paris, the higher classes in the latter being comparatively poor; but fiacres and cabriolets are very numerous. The houses are generally of stone, six or seven stories high, with one gable or wing to the street, and with the lower windows barricaded with iron. The street entrance is often by a massive gate which opens into a court, and out of this court there is one common entrance into a large building called a hotel, the first floor of which is probably occupied by a person of rank, who pays 300l. per annum of rent; above him are tenants in different gradations of fashion or opulence, to the sixth or seventh floor, which is inhabited by the milkman, the cobler, or the scavenger, paying only ten pounds of rent. The whole of this ill assorted community use the same magnificent staircase, decorated with marble columns and bas-reliefs, and embrowned by the filth of a hundred dirty feet. When a hotel (or large house) is inhabited by one opulent or noble family, it is not unusual to make the upper story the receptacle for the hay and provender for the horses. The lamps are suspended by cords across the middle of the street, but usually afford more light than those of London. The shops are generally small and dark, without projecting windows for the display of goods, or any other mark to distinguish them except a sign-board. In viewing the city from a distance, nothing strikes an Englishman more than the great transparency of the atmosphere, and absence of that cloud of smoke which hovers over our cities, in consequence of the use of pitcoal for fuel: the Parisians scarcely use any thing else than wood.

Paris surpasses all the other capitals of Europe in in the number and splendour of its public edifices. Of these one of the most distinguished is the Palace of the Thuilleries, founded by Catherine de Medicis. The front consists of five pavilions comprising that of the centre, with four ranges of buildings connecting them together, and forming one grande façade, adorned with columns of the various orders, and with vases and statues. In front of the building stands a beautiful triumphal arch erected by Napoleon. Behind it are extensive gardens laid out with exquisite taste by Lenostre, embellished with orange trees, statues, fountains, and basins of water. In the morning they are the resort of the politician, who is accommodated with a chair and newspaper for four sous; in the evening they are crowded with gay and fashionable company. 2. The *Palais Royal*, originally built by Cardinal Richelieu, is a magnificent edifice adorned with Doric and Ionic columns, with a garden, basin, and fountain. The arcades of the ground story are occupied by innumerable shops, of small dimensions, but elegantly fitted up. Beneath are apartments where various groups are dancing, regaling with liquor, engaged in play, or in scenes of vice and debauchery. Other apartments are occupied by restaurateurs, lecturers on belles lettres and philosophy, or literary societies. It is in short a little world within itself. 3. The Luxembourg, or Palace of the Chamber of Peers, is one of the most magnificent palaces in Paris. It consists of one vast court of a square form, 360 feet by 300, surrounded by porticos, and flanked by square buildings called pavilions. The garden is fine, and from its elevated situation commands many delightful views of the city. 4. The Palace of Justice is a large and handsome building, forming three sides of a square, and occupied partly by some of the tribunals. 5. The Hotel de Bourbon, or Palace of the Representatives, is chiefly distinguished by its noble portico, with a colonnade of the Corinthian order surmounted by a pediment. It is delightfully situated on the banks of the Seine. 6. The Louvre is connected by a gallery with the Thuilleries. The façade of this building, called the colonnade, is justly regarded as one of the most perfect pieces of architecture to be found anywhere. In this building was the celebrated museum, which was stript of so many works of art after the battle of Waterloo. 7. The Palace of the Fine Arts, formerly called the College of the Four Nations, is an elegant edifice of a semicircular form, with a dome which is much admired. It contains two libraries; and the school of fine arts, and the meetings of the institute, now called the royal academy, are held here. 8. The Royal Observatory, erected in 1667, is distinguished by the simplicity of its design and the harmony of its parts. It is vaulted throughout, and has neither wood nor iron in its construction. It has a well 170 feet deep, to the bottom of which there is a descent by a stair; and the

Paris.

stair is so constructed as to leave a vacuity in the middle, through which the stars are seen from the bottom of the well at midday. Three astronomers are always resident here. 9. The Hotel de Ville, or town hall, is worthy of notice both for its antiquity and its architecture. It is rich in beauty and ornament. An equestrian statue of Henry IV. in bas relief is placed over the principal entrance. Hither Robespierre retreated after he was outlawed. In front of the Hotel de Ville is the famous lamp iron, and within it is preserved the still more famous guillotine. 10. The Mint is one of the finest ornaments of the banks of the Seine. It is 360 feet long by 84 in height, and combines simplicity of design, with a tasteful display of ornament. 11. The cathedral of Notre Dame, the mother church of France, was built about the year 1010, or according to others 1177. Its architecture, though Gothic, is singularly bold and delicate, and it has ever been esteemed one of the handsomest structures in the kingdom. It is 414 feet long, 144 wide, and 102 high. 12. *Abbay du Val de Grace*, now converted into an hospital; it has a fine dome decorated in the inside with some excellent fresco paintings. 13. The church of St Eustache, is a model of the boldness and lightness of the Gothic style. 14. The Pantheon, a large and magnificent temple, 339 feet long by 253 broad, with a dome rising to the height of 282 feet. The portal, formed by 22 Corinthian columns 58 feet high, is 112 feet long and 36 deep, and is crowned with a grand bas relief, sculptured by Coustou. It was originally built on a plan too light to sustain its own weight, and the alterations rendered necessary to support it, have injured its beauty: but it is still a grand and imposing structure. It was designed to commemorate men whose talents or achievements had reflected honour on their country. There are four Protestant churches in Paris, of which that in the Rue St Honoré is much admired for its elegance; and two Jewish synagogues. Several of the remaining convents are worth visiting. The Catacombs of Paris are justly classed among the curiosities of the place. These are very extensive quarries excavated in ancient times in the limestone rock under the city, and used at a later period as a depository for the bones of the dead. For many centuries the inhabitants of Paris buried their dead in large trenches, into which the corpses were thrown in heaps, and thinly covered with earth. From the small extent of the burying grounds, these trenches were soon opened again, and the putrid mass often spread contagion over the town. At length the government forbid all burials within the walls, and had these immense masses of corruption which had been accumulating for ten centuries, taken up, the bones separated and cleaned, and deposited in these catacombs. They are placed along the walls in rows, those of one size and kind being placed together. There are some of the apartments resembling chapels, in which are vases and altars sometimes formed of human bones, and sometimes having skulls of different sizes disposed about them as ornaments. Some of the altars are cut out of the solid rock; and it is believed that, in a very early age, they were frequented as places of Christian worship. The descent to these caverns is by a narrow staircase of eighty steps, and the visitor is conducted out at another passage more than half a mile distant. The guide as well as the stranger bears a torch; the former traces his course by a black line marked on the roof. Without this, there would be a risk of losing the way amidst the labyrinth of passages and chambers.

There are upwards of seventy squares in Paris, many of which are well deserving of attention for the beauty, richness, and uniformity of the buildings, and for the columns and statues that adorn them. Among these may be mentioned the Place des Victoires, Place Vendome, Place de Louis XV. There are sixty fountains, some of which exhibit very beautiful specimens of architecture. The Fountain of the Elephant, in which the water was to have been thrown out from the trunk of a bronze statue of an elephant 72 feet high, was begun by Napoleon, but was left unfinished at his overthrow, and the work has not since been resumed. The bridges of Paris cannot vie with those of London. The most remarkable are, the Pont Neuf, completed by Henry the fourth, 996 feet long, and 90 broad. The Pont Royal; Pont Louis XVI; Pont au Change; Pont St Michael; Pont Notre Dame; Pont de la Tournelle; Pont de Austerlitz, completed in 1807; Pont de Jena, lately finished; Pont des Arts, consisting of nine cast metal arches. Paris contains also a number of triumphal arches. Those called the Gate of St Dennis and the Gate of St Martin were erected in the reign of Louis XIV, and are very fine pieces of architecture. The triumphal arch of the Thuilleries erected by Bonaparte, is also of exquisite workmanship; but the bronze horses which were placed over it have been restored to Venice, and the statue of Napoleon has been cast down.

The hospitals and charitable institutions of Paris which are numerous, and many of them on an extensive scale, are supported by the government. More than 15,000 beds are made up at the different hospitals, and the annual expenditure is computed at 300,000l. sterling. The Hotel des Invalids, or hospital for disabled and superannuated soldiers, is a magnificent building, in a fine situation near the Seine. The colours taken from the different nations which were suspended here, were burnt by the veterans, when the allies were before Paris, to prevent them from being retaken. We can only mention the Hotel Dieu, or hospital for the sick, the Hospice de Salpetriere, which is a charity workhouse for women, the Hospital de Charité, Maison de Santé, the Hospital de Maternité for lying-in women and foundling children. There is besides a foundling hospital.

The Royal University of Paris, suppressed in 1792, but since re-established, consists of four faculties, viz. theology, in which there are six professors; law, in which there are seven; surgery, in which there are about twenty lecturers, many of whom are men of distinguished abilities; and lastly, letters and science, which includes professorships on philosophy, literature, poetry, history, and geography. At the royal college of France, lectures are given gratuitously on many branches of science and literature; and among the lecturers are the names of Delambre, Biot, Portal, and Cuvier. At the polytechnic school, about 300 young men, selected from those who have distinguished themselves at the inferior schools, are furnished with the higher branches of education gratuitously. They go chiefly into the service of the artillery. There are besides a school of the fine arts, a school of mines, and a variety of others. The institution

institution for the blind, and that for the deaf and dumb, are meritorious establishments, and extremely well conducted. The museums and libraries of various kinds in Paris, are too numerous to admit of separate description here. The museum of natural history includes a botanic garden, a menagerie, a collection of minerals, of animal remains, of anatomy, with a library, all on the most extensive scale, and in the most perfect order. The museum of French monuments contains many interesting remains of antiquity, along with those of a late period. The Louvre, though it has been despoiled of many of its choicest pieces, still presents 1104 pictures, with 355 specimens of sculpture. Of the 1200 paintings of the great gallery, however, about 950 were carried away. Those with which it is now filled have been furnished from other galleries, and from private collections. The royal library was founded by King John, and has ever since been increasing. It is now the most magnificent library in Europe, containing 360,000 printed books, besides 80,000 MSS. Tables are placed in the room for the accommodation of visitors, who may call for whatever books they please, and are immediately supplied with them. There are several other public libraries upon a less extensive scale.

At one period of the revolution there were thirty theatres in Paris opened nightly. At present the number is limited to ten, four large, and six smaller. The first of these in point of rank is the Theatre Français, at which the exhibitions are chiefly confined to the classical productions of the French stage. The opera is unrivalled for the beauty and splendour of the ballet, and the excellence of the dancing; but the singing is not above mediocrity.

Paris, *Herb Paris*, or *Truelove*, a genus of plants belonging to the octandria class, and in the natural method ranking under the 11th order, *Sarmentaceæ*. See Botany *Index*.

Herb Paris of Canada, a genus of plants belonging to the hexandria class. See Trillium, Botany *Index*.

Plaster of Paris, or *Stucco*, or *Parget of Montmartre*, the first and the last name being derived from the place where it is found in great abundance, is a substance composed of lime and sulphuric acid, which on account of its property of rapidly absorbing water, after being calcined, is much employed in making casts and models. See Gypsum, Mineralogy and Geology *Index*.

PARISH, the precinct of a parochial church, or a circuit of ground inhabited by people who belong to one church, and are under the particular charge of its minister.

The word comes from the Latin *parochia*, the Greek παροικια, *habitation*; compounded of παρα, *near*, and οικος, house.—Accordingly Du Cange observes, that the name παροικια was anciently given to the whole territory of a bishop, and derives it from *neighbourhood*; because the primitive Christians, not daring to assemble openly in cities, were forced to meet secretly in neighbouring houses.

In the ancient church there was one large edifice in each city for the people to meet in; and this they called *parochia*, "Parish." But the signification of the word was afterwards enlarged, and by a parish was meant a diocese, or the extent of the jurisdiction of a bishop, consisting of several churches, unless we will suppose, as some do, that those bishops were only pastors of single churches. Du Pin observes, that country parishes had not their origin before the 4th century; but those of cities are more ancient. The city of Alexandria is said to have been the first that was divided into parishes.

Of the first division of parishes there is no certain information; for in the early ages of Christianity in this island, parishes were unknown, or at least signified the same that a diocese now does. There was then no appropriation of ecclesiastical dues to any particular church; but every man was at liberty to contribute his tithes to any priest or church he pleased, but he he was obliged to do it to some; or if he made no special appropriation thereof, they were paid to the bishop, whose duty it was to distribute them among the clergy, and for other pious purposes, according to his own discretion. Camden says England was divided into parishes by Archbishop Honorius about the year 630. Sir Henry Hobart maintains that parishes were first erected by the council of Lateran, held A. D. 1179. But Mr Selden proves, that the clergy lived in common without any division of parishes, long after the time mentioned by Camden; and it appears from the Saxon laws, that parishes were in being long before the council of Lateran in 1179. The distinction of parishes occurs in the laws of King Edgar, about the year 970. It seems pretty clear and certain, says Judge Blackstone (Com. vol. i. p. 112.) that the boundaries of parishes were first ascertained by those of a manor or manors; because it very seldom happens that a manor extends itself over more than one parish, though there are often many manors in one parish. The lords, he adds, as Christianity spread, began to build churches upon their own demesnes or wastes, in order to accommodate their tenants in one or two adjoining lordships; and that they might have divine service regularly performed therein, obliged all their tenants to appropriate their tithes to the maintenance of the one officiating minister, instead of leaving them at liberty to distribute them among the clergy of the diocese in general; and this tract of land, the tithes of which were so appropriated, formed a distinct parish; and this accounts for the frequent intermixture of parishes one with another. For if a lord had a parcel of land detached from the main of his estate, but not sufficient to form a parish of itself, it was natural for him to endow his newly erected church with the tithes of such lands. Extra-parochial wastes and marsh lands, when improved and drained, are by 17 Geo. II. cap. 37. to be assessed to all parochial rates in the parish next adjoining. Camden reckons 9284 parishes in England; and Chamberlayne makes 9913. They are now generally reckoned about 10,000.

Parish-Clerk. In every parish the parson, vicar, &c. hath a parish clerk under him, who is the lowest officer of the church. These were formerly clerks in orders, and their business at first was to officiate at the altar; for which they had a competent maintenance by offerings; but they are now laymen, and have certain fees with the parson on christenings, marriages, burials, &c. besides wages for their maintenance. The law looks upon them as officers for life: and they are chosen by the minister of the parish, unless there is a custom for the parishioners or churchwardens to choose them; in which case the canon cannot abrogate such custom; and when chosen it is to be signified, and they

Parish ‖ Park.

they are to be sworn into their office by the archdeacon, for which the court of king's bench will grant a mandamus.

PARISII, in *Ancient Geography*, a people of Gallia Celtica, inhabiting the country about the Sequana and Matrona. Now a great part of the Isle of France.—*Parisii* (Ptolemy), a people of Britain, having the Brigantes to the north and west, the German sea to the west, and the Coritani to the south, from whom they were separated by the Humber. Now *Holdernesse*, a peninsula of the east riding of Yorkshire.

PARISIORUM CIVITAS. See LUTETIA.

PARIUM, in *Ancient Geography*, a noble city of Mysia Minor, with a port on the Propontis; called *Adrastia* by Homer, according to Pliny; but Strabo distinguishes them: according to others, the *Paestos* of Homer. *Pariani*, the people (Strabo). The birthplace of Neoptolemus surnamed *Glossographus* (Strabo). Here stood a Cupid equal in exquisite workmanship to the Cnidian Venus.

PARK (French *parque*, i. e. *locus inclusus*), is a large quantity of ground enclosed and privileged for wild beasts of chase, by the king's grant or prescription. See CHASE and FOREST.

Manwood defines a chase to be "a privileged place, for beasts of venery, and other wild beasts of the forest and chase, *tam sylvestres quam campestres*;" and differs from a chase or warren, in that it must be enclosed: for if it lies open, it is good cause of seizure into the king's hand, as a thing forfeited; as a free chase is, if it be enclosed: besides, the owner cannot have an action against such as hunt in his park, if it lies open. No man can erect a park without license under the broad seal; for the common law does not encourage matter of pleasure, which brings no profit to the commonwealth. But there may be a park in reputation erected without any lawful warrant; and the owner may bring his action against persons killing his deer.

To a park three things are required. 1. A grant thereof. 2. Enclosures by pale, wall, or hedge. 3. Beasts of a park; such as the buck, doe, &c. And where all the deer are destroyed, it shall no more be accounted a park; for a park consists of vert, venison, and enclosure: and if it is determined in any of them, it is a total disparking.

Parks as well as chases are subject to the common law, and are not to be governed by the forest laws.

PARK, as connected with gardening. See GARDENING.

A park and a garden are more nearly allied than a farm and a garden*, and can therefore be accommodated to each other without any disparagement to either. A farm loses some of its characteristic properties by the connexion, and the advantage is on the part of the garden: but a park thus bordered retains all its own excellencies; they are only enriched, not counteracted, by the intermixture. The most perfect composition of a place that can be imagined, consists of a garden opening into a park, with a short walk through the latter to a farm, and ways along its glades to ridings in the country; but to the farm and the ridings the park is no more than a passage; and its woods and its buildings are but circumstances in their views; its scenes can be communicated only to the garden.

* See *Farm* and *Gardening*.

Park.

The affinity of the two objects is so close, that it would be difficult to draw the exact line of separation between them. Gardens have lately encroached very much both in extent and in style on the character of a park; but still there are scenes in the one which are out of the reach of the other. The small sequestrated spots which are agreeable in a garden would be trivial in a park; and the spacious lawns which are among the noblest features of the latter, would in the former fatigue by their want of variety; even such as, being of a moderate extent, may be admitted into either, will seem bare and naked, if not broken in the one; and lose much of their greatness, if broken in the other. The proportion of a part to the whole is a measure of its dimensions: it often determines the proper size for an object, as well as the space fit to be allotted to a scene; and regulates the style which ought to be assigned to either.

But whatever distinctions the extent may occasion between a park and a garden, a state of highly cultivated nature is consistent with each of their characters; and may in both be of the same kind, though in different degrees.

The excellencies both of a park and of a garden are happily blended at Hagley (A), where the scenes are equally elegant and noble. It is situated in the midst of a fertile and lovely country, between the Clent and the Witchberry hills; neither of which are within the pale but both belong to the place. The latter rise in three beautiful swells. One of them is covered with wood; another is an open sheep walk, with an obelisk on the summit; on the third, the portico of the temple of Theseus, exactly on the model of that of Athens, and little less in the dimensions, stands boldly out upon the brow, backed by the dark ground of a fir plantation, and has a most majestic appearance above the steeps which fall before and beside it. The house is seen to the greatest advantage from these eminences, and every point of them commands some beautiful prospect. The busy town of Stourbridge is just below them; the ruins of Dudley castle rise in the offskip; the country is full of industry and inhabitants; and a small portion of the moor, where the minerals, manufactured in the neighbourhood, are dug, breaking in upon the horizon, accounts for the richness, without derogating from the beauty, of the landscape. From the Clent hills the views are still greater: they extend on one side to the black mountains in Wales, a long ridge which appears, at 60 miles distance, in the interval between the unwieldy heap of the Malvern hills and the solitary peak of the Wrekin, each 30 miles off, and as many asunder. The smoke of Worcester, the churches in Birmingham, and the houses in Stourbridge, are distinctly visible. The country is a mixture of hill and dale, and strongly enclosed; except in one part, where a heath, varied by rising grounds, pieces of water, and several objects, forms an agreeable contrast to the cultivation

(A) Near Stourbridge, in Worcestershire, the seat of Lord Lyttleton.

Park. vation which surrounds it. From the other extremity of the Clent hills, the prospect is less extensive; but the ground is more rude and broken; it is often overspread with large and beautiful woods; and the view is dignified with numerous seats. The hills also being very irregular, large advanced promontories frequently interrupt the sight, and vary the scene: in other parts, deep valleys shelving down towards the country below, exhibit the objects there in different lights. In one of these hollows is built a neat cottage, under a deep descent, sheltered besides by plantations, and presenting ideas of retirement in the midst of so much open exposure: from the heights above it, is seen all that view which before was commanded from the Witchberry hills, but which is seen here over Hagley park; a noble fore ground, beautiful in itself, and completing the landscape.

The house, though low in the park, is yet above the adjacent country, which it overlooks to a very distant horizon. It is surrounded by a lawn of fine uneven grounds, and diversified with large clumps, little groups, and single trees. It is open in front, but covered on one side by the Witchberry hills; on the other side, and behind, by the eminences in the park, which are high and steep, and all overspread with a lofty hanging wood. The lawn pressing to the foot, or creeping up the slopes of these hills, and sometimes winding along glades into the depth of the wood, traces a beautiful outline to a sylvan scene, already rich to luxuriance in massiness of foliage and stateliness of growth.

But though the wood appears to be entire, it in reality opens frequently into lawns, which occupy much of the space within it. In the number, the variety, and the beauty of these lawns, in the shades of the separation between them, in their beauties also, and their varieties, the glory of Hagley consists. No two of the openings are alike in dimensions, in shape, or in character. One is of no more than five or six acres; another of not less than fifty; and others are of all the intermediate sizes. Some stretch out into lengthened glades; some widen every way: they are again distinguished by buildings, by prospects, and often by the style only of the plantations around them. The boundary of one is described by a few careless lines; that of another is composed of many parts, very different, and very irregular; and the ground is never flat, but falls sometimes in steep descents, sometimes in gentle declivities, waves along easy swells, or is thrown into broken inequalities, with endless variety.

An octagon seat, sacred to the memory of Thomson, and erected on his favourite spot, stands on the brow of a steep; a mead winds along the valley beneath, till it is lost on either hand behind some trees. Opposite to the seat, a noble wood crowns the top, and feathers down to the bottom of a large oval swelling hill. As it descends on one side, the distant country becomes the offskip. Over the fall, on the other side, the Clent hills appear. A dusky antique tower stands just below them, at the extremity of the wood; and in the midst of it is seen a Doric portico, called *Pope's Building*, with part of the lawn before it. The scene is very simple: the principal features are great; they prevail over all the rest, and are intimately connected with each other.

The next opening is small, circling about a rotunda on a knoll, to the foot of which the ground rises every way. The trees which surround it are large; but their foliage is not very thick; and their stems appearing beneath, their ramifications between the boughs are, in so confined a spot, very distinguished and agreeable circumstances. It is retired; has no prospect; no visible outlet but one, and that is short and narrow, to a bridge with a portico upon it, which terminates a piece of water.

The grove behind the rotunda separates this from a large, airy, forest glade, thinly skirted with wood, careless of dress, and much overgrown with fern. The wildness is an acceptable relief in the midst of so much elegance and improvement as reign in the neighbouring lawns: and the place is in itself pleasant; in no part confined; and from a Gothic seat at the end is a perspective view of that wood and tower which were seen before in front, together with the Witchberry hills, and a wide range of country.

The tower, which in prospect is always connected with wood, stands, however, on a piece of down, which stretches along the broad ridge of a hill, and spreads on each hand for some way down the sides. Thick groves catch the falls. The descent on the right is soon lost under the trees; but that on the left being steeper and shorter, it may be followed to the bottom. A wood hangs on the declivity, which is continued in the valley beneath. The tower overlooks the whole: it seems the remains of a castle, partly entire, partly in ruins, and partly overgrown with bushes. A finer situation cannot be imagined: It is placed in an exposed unfrequented spot; commands an extensive prospect; and is everywhere an interesting object.

At the end of the valley below it, in an obscure corner, and shut out from all view, is a hermitage, composed of roots and of moss: high banks, and a thick covert darkened with horse chesnuts, confine the sequestered spot: a little rill trickles through it, and two small pieces of water occupy the bottom. They are seen on one side through groups of trees; the other is open, but covered with fern. This valley is the extremity of the park; and the Clent hills rise in all their irregularity immediately above it.

The other descent from the castle is a long declivity, covered like the rest with noble woods, in which fine lawns are again embosomed, differing still from the former, and from each other. In one, the ground is very rough, the boundary is much broken, and marked only by the trunks of the trees which shoot up high before the branches begin. The next is more simple; and the ground falls from an even brow into one large hollow, which stops towards the glen, where it sinks into the covert. This has a communication through a short glade, and between two groves, with another called the *Tinian lawn*, from the resemblance which it is said to bear to those of that celebrated island: it is encompassed with the stateliest trees, all fresh and vigorous, and so full of leaf, that not a stem, not a branch, appears, but large masses of foliage only describe an undulating outline; the effect, however, is not produced by the boughs feathering down to the bottom; they in appearance shoot out horizontally, a few feet above the ground, to a surprising distance, and form underneath an edging of shade, into which the retreat is immediate at every hour of the day. The verdure of the

Park. the turf is as luxuriant there as in the open space: the ground gently waves in both over easy swells and little dips, just varying, not breaking, the surface. No strong lines are drawn; no striking objects are admitted; but all is of an even temper, all mild, placid, and serene; in the gayest season of the day not more than cheerful, in the stillest watch of night not gloomy. The scene is indeed peculiarly adapted to the tranquillity of the latter, when the moon seems to repose her light on the thick foliage of the grove, and steadily marks the shade of every bough. It is delightful then to saunter here, and see the grass, and the gossamer which entwines it, glistening with dew; to listen and hear nothing stir, except perhaps a withered leaf dropping gently through a tree; and, sheltered from the chill, to catch the freshness of the evening air: a solitary urn, chosen by Mr Pope for the spot, and now inscribed to his memory, when shown by a gleam of moonlight through the trees, fixes that thoughtfulness and composure to which the mind is insensibly led by the rest of this elegant scene.

The Doric portico, which also bears his name, though not within sight, is near: it is placed on the declivity of a hill; and Thomson's seat, with its groves and appendages, are agreeable circumstances in the prospect before it. In the valley beneath is fixed a bench, which commands a variety of short views; one is up the ascent to the portico, and others through openings in the wood to the bridge and the rotunda.

The next lawn is large: the ground is steep and irregular, but inclines to one direction, and falls from every side into the general declivity: the outline is diversified by many groups of trees on the slopes; and frequent glimpses of the country are seen in perspective through openings between them. In the brow is a seat, in the proudest situation of all Hagley; it commands a view down the bold sweep of the lawn, and over a valley filled with the noblest trees, up to the heights beyond. One of those heights is covered with a hanging wood; which opens only to show Thomson's seat, and the groves and the steeps about it; the others are the Witchberry hills, which seem to press forward into the landscape; and the massy heads of the trees in the vale, uniting into a continued surface, form a broad base to the temple of Theseus, hide the swell on which it is built, and crowd up to the very foundation. Farther back stands the obelisk; before it is the sheep walk; behind it the Witchberry wood. The temple is backed by the firs; and both these plantations are connected with that vast sylvan scene which overspreads the other hill and all the intermediate valley. Such extent of wood; such variety in the disposition of it; objects so illustrious in themselves, and ennobled by their situations, each contrasted to each, every one distinct, and all happily united; the parts so beautiful of a whole so great, seen from a charming lawn, and surrounded by a delightful country, compose all together a scene of real magnificence and grandeur.

The several lawns are separated by the finest trees; which sometimes grow in airy groves, chequered with gleams of light, and open to every breeze; but more frequently, whose great branches meeting or crossing each other, cast a deep impenetrable shade. Large boughs feathering down often intercept the sight; or a vacant space is filled with coppice wood, not, hawthorn, and hornbeam, whose tufted heads mixing with the foliage, and whose little stems clustering about the trunks of the trees, thicken and darken the plantation. Here and there the division is of such coppice wood only, which then being less constrained and oppressed, springs up stronger, spreads further, and joins in a low vaulted covering: in other places the shade is high, overarched by the tallest ash, or spreads under the branches of the most venerable oaks. They rise in every shape, they are disposed in every form in which trees can grow. The ground beneath them is sometimes almost level; sometimes a gentle swell; but generally very irregular and broken. In several places, large hollows wind down the sides of the hills, worn in the stormy months by water courses, but worn many ages ago. Very old oaks in the midst of the channels prove their antiquity: some of them are perfectly dry most part of the year; and some are watered by little rills all the summer: they are deep and broad; the sides are commonly steep; often abrupt and hollow; and the trees on the bank sometimes extend their roots, all covered with moss, over the channels of the water. Low down in one of these glens, under a thick shade of horse chesnuts, is a plain bench, in the midst of several little currents and water falls, running among large loose stones, and the stumps of dead trees, with which the ground is broken. On the brink of another glen, which is distinguished by a numerous rookery, is a seat in a still wilder situation, near a deeper hollow, and in a darker gloom: the falls are nearly perpendicular; the roots of some of the trees are almost bare, from the earth having crumbled away; large boughs of others, sinking with their own weight, seem ready to break from the trunks they belong to; and the finest ash, still growing, lie all aslant the water course below, which, though the streams run in winter only, yet constantly retains the black tinge of damp, and casts a chill all around.

Gravel walks are conducted across the glens, through the woods, the groves, or the thickets, and along the sides of the lawns, concealed generally from the sight, but always ready for the communication, and leading to the principal scenes. The frequency of these walks, the number and the style of the buildings, and the high preservation in which all the place is kept, give to the whole park the air of a garden. There is, however, one spot more peculiarly adapted to that purpose, and more artificially disposed than the rest; it is a narrow vale, divided into three parts: one of them is quite filled with water which leaves no room for a path, but thick trees on either side come down quite to the brink; and between them the sight is conducted to the bridge with a portico upon it, which closes the view: another part of this vale is a deep gloom, overhung with large ash and oaks, and darkened below by a number of yews: these are scattered over very uneven ground, and open underneath; but they are encompassed by a thick covert, under which a stream falls from a stony channel, down a rock; other rills drop into the current, which afterwards pours over a second cascade into the third division of the vale, where it forms a piece of water, and is lost under the bridge. The view from this bridge is a perfect opera scene, through all the divisions of the vale up to the rotunda. Both these buildings, and the other decorations of the spot, are of the species generally confined

ned to a garden. The hermitage also, which has been described, and its appendages, are in a style which does not belong to a park; but through all the rest of the place, the two characters are intimately blended. The whole is one subject; and it was a bold idea to conceive that one to be capable of so much variety; it required the most vigorous efforts of a fertile fancy to carry that idea into execution. See GARDENING.

PARK of Artillery. See ARTILLERY.

PARK of Provisions, in military affairs, the place where the sutlers pitch their tents in the rear, and sell their provisions to the soldiers. Likewise that place where the bread waggons are drawn up, and where the troops receive their ammunition bread, being the store of the army.

PARKER, MATTHEW, the second Protestant archbishop of Canterbury, was born at Norwich in the year 1504, the 19th of Hen. VII. His father, who was a man in trade, died when our author was about twelve years old; but his mother took special care of his education, and at the age of 17 sent him to Corpus Christi college in Cambridge, where, in 1523, he took his bachelor's degree. In 1527 he was ordained, created master of arts, and chosen fellow of the college. Having obtained a license to preach, he frequently held forth at St Paul's cross in London, and in other parts of the kingdom. In 1533 or 1534 he was made chaplain to Queen Anne Boleyn, who obtained for him the deanery of Stoke Clare in Suffolk, where he founded a grammar school. After the death of the queen, King Henry made him his own chaplain, and in 1541 prebendary of Ely. In 1544, he was, by the king's command, elected master of Corpus Christi college, and the following year vice chancellor of the university. In 1547 he lost the deanery of Stoke, by the dissolution of that college. In the same year he married the daughter of Robert Harlestone, a Norfolk gentleman.

In the year 1552 he was nominated, by Edward VI. to the deanery of Lincoln, which, with his other preferments, enabled him to live in great affluence: but Mary had scarcely succeeded to the throne before he was deprived of every thing he held in the church, and was then obliged to live in obscurity, frequently changing his place of abode to avoid the fate of the other reformers.

Queen Elizabeth ascended the throne in 1558; and in the following year Dr Parker, from indigence and obscurity, was at once raised to the see of Canterbury; an honour which he neither solicited nor desired. In this high station he acted with spirit and propriety. He visited his cathedral and diocese in 1560, 1565, and 1573. He repaired and beautified his palace at Lambeth at a vast expence. The sum which the repairs of the palace and great hall at Canterbury cost him was upwards of 1400l. sterling, which is at least equal to ten times the sum now-a-days. Both the palace and great hall were in decay, partly through the injuries of time, and partly through that of fire. The hall, built by Archbishop Huber in the 12th century, was famous in history for the great feasts that had been given there by archbishops and abbots in former times; in particular, at the nuptial feasts of King Edward I. in 1290; at the installation of the abbot of St Austin's in 1309; at the enthronization of George Nevill, archbishop of York, in 1464; and of Archbishop Warham in 1504, when Edward duke of Buckingham acted as lord high steward of his household; and lastly, for the entertainment given by that archbishop in 1519 to the emperor Charles V. Henry VIII. Queen Catherine, &c. In 1565 Archbishop Parker gave three entertainments in this hall at Whitsuntide (which lasted three days), on Trinity Sunday, and in assize time. At the two first of these the archbishop himself sat in the midst of the uppermost table; on his left hand the mayor, &c. and so on one side of the hall a continued row of men according to their rank filled the other tables; and on his right hand sat only some noble women and ladies of quality, the whole length of the hall, corresponding to the row of men on the other side: which order of placing the women was observed in honour of the queen. The first rank of guests having risen, and the tables cleared, they were furnished again, and filled the second time. At the last feast which was grander than all the rest, the archbishop entertained the two judges who went that circuit (B), the attorney-general, the high-sheriff, with all who met at these assizes, as justices of the peace, advocates, and common lawyers, and all the rest of proctors and attorneys; who all (with a promiscuous company) in troops came in. The hall was set forth with much plate of silver and gold, adorned with much tapestry of Flanders; and dainties of all sorts were served in excellent order by none but the archbishop's servants, the table being often the same day furnished afresh with new guests; while the ladies were nobly entertained in inner parlours by Mrs Parker, the hall being now filled with gentlemen. Otherwise, at these feasts, it was the archbishop's custom, in honour of matrimony, to entertain both men and their wives. Of this noble hall and palace, now within 200 years, there is little or nothing left except a few ruins. On Whitsunday 1570, and the two following days, this archbishop feasted the citizens of Canterbury and their wives in the same manner as he had done before: and on Trinity Sunday (after consecrating Bishop Curteis of Chichester) he made another most archiepiscopal feast, inviting another archbishop (viz. Grindal of York, who came thither for confirmation) to be his guest: besides whom were present Horn bishop of Winchester, and Curteis bishop of Chichester. At the lower tables sat all the ministers and servants whatsoever, even the children, who belonged to that church; and at the remotest tables, but in the same hall, in sight, sat the poor of both sexes of the hospitals of St John's and Harbledown. On July 11th, being assizes time, the judges, high-sheriff, gentlemen, and the common sort, were all feasted by the archbishop in a splendid manner as before. Soon after Bishop Sandys of Worcester, elect of London, came to Canterbury to be confirmed. The archbishop, on his return, lodged the first night at Sittingbourn, and the next night (after dining at Gravesend)

(B) This proves that the judges of assize then came to Canterbury, though it was then a county in itself, being so made in 1461.

Parker.

send) came to Lambeth in barges by Thames, with all his family. Sept. 7. 1573, being Q. Elizabeth's birthday, Archbishop Parker entertained her majesty, and as many noblemen, &c. as were present at Archbishop Warham's entertainment in the same hall 54 years before. The archbishop (to use his own words, in a letter to Archbishop Grindal of York) "met her highness, as she was coming to Dover, upon Folkstone Down. I left her at Dover, and came home to Bekesborn that night; and after that went to Canterbury to receive her majesty there. Which I did, with the bishops of Lincoln and Rochester, and my suffragan (of Dover), at the west door; where, after the grammarian had made his oration to her upon her horse-back, she alighted. We then kneeled down, and said the psalm *Deus misereatur*, in English, with certain other collects briefly; and that in our chimers and rochets. The quire, with the dean and prebendaries, stood on either side of the church, and brought her majesty up with a song; she going under a square canopy, borne by four of her temporal knights, to her traverse, placed by the communion board, where she heard evening song; and after departed to her lodging at St Austin's, whither I waited upon her. From thence I brought certain of the council, and divers of the court, to my house to supper, and gave them 14 or 15 dishes, furnished with two mess, at my long table, whereat sat about 20; and in the same chamber a third mess, at a square table, whereat sat 10 or 12; my less hall having three long tables furnished with my officers, and with the guard, and others of the court: and so her majesty came every Sunday to church to hear the sermon. And upon one Monday it pleased her highness to dine in my great hall, thoroughly furnished with the council, Frenchmen, ladies, gentlemen, and the mayor of the town, with his brethren, &c.; her highness sitting in the midst, having two French ambassadors (Gondius and Mothe-Fenelon) at the end of the table, and four ladies of honour at the other end. And so three mess were served by her nobility at washing, her gentleman and guard bringing her dishes, &c." On which the archbishop of York, in his answer, made this reflection: "Your grace's large description of the entertainment at Canterbury did so lively set forth the matter, that in reading thereof I almost thought myself to be one of your guests there, and as it were beholding the whole order of all things done there. Sir, I think it shall be hard for any of our coat to do the like for one hunded years, and how long after God knoweth." In this progress Lord Treasurer Burleigh was lodged with Mr Pearson, the eleventh prebendary, who, the archbishop says, "had a fine house."

He founded several scholarships in Bennet or Corpus-Christi college in Cambridge, and gave large presents of plate to that and to other colleges in this university. He gave 100 volumes to the public library. He likewise founded a free school at Rochdale in Lancashire. He took care to have the sees filled with pious and learned men; and, considering the great want of Bibles in many places, he, with the assistance of other learned men, improved the English translation, had it printed on a large paper, and dispersed through the kingdom. This worthy prelate died in the year 1575, aged 72, and was buried in his own chapel at Lambeth. He was pious without affectation or austerity, cheerful and contented in the midst of adversity, moderate in the height of power, and beneficent beyond example. He wrote several books; and also published four of our best historians, *Matthew of Westminster*, *Matthew Paris*, *Asser's Life of King Alfred*, and *Tho. Walsingham*. The learned archbishop also translated the Psalter. This version was printed, but without a name; and has been attributed to an obscure poet of the name of Keeper. This was Wood's opinion; but it is more than probable that the learned author of the *Athenæ Oxon.* was wrong. See Gentleman's Magazine for 1781, p. 566. where Parker is proved to be the author of a version of the Psalms.

Parker ‖ Parliament.

PARKINSONIA, a genus of plants, belonging to the decandria class; and in the natural method ranking under the 33d order, *Lomentaceæ*. See BOTANY *Index*.

PARLEY, a conference with an enemy. Hence, to beat or sound a parley, is to give a signal for holding such a conference by beat of drum, or sound of trumpet.

PARLIAMENT, the grand assembly of the three states of this kingdom, summoned together by the king's authority, to consider of matters relating to the public welfare, and particularly to enact and repeal laws. 1 Definition.

The original or first institution of parliament is one of those matters which lie so far hidden in the dark ages of antiquity, that the tracing of it out is a thing equally difficult and uncertain. The word *parliament* itself (or *colloquium*, as some of our historians translate it) is, comparatively, of modern date; derived from the French, and signifying "the place where they met and conferred together." It was first applied to general assemblies of the states under Lewis VII. in France, about the middle of the 12th century. But it is certain, that long before the introduction of the Norman language into England, all matters of importance were debated and settled in the great councils of the realm. A practice which seems to have been universal among the northern nations, particularly the Germans; and carried by them into all the countries of Europe, which they overran at the dissolution of the Roman empire. Relicks of which constitution, under various modifications and changes, are still to be met with in the diets of Poland, Germany, and Sweden, and lately in the assembly of the estates in France: for what is there now called the *parliament*, is only the supreme court of justice, consisting of the peers, certain dignified ecclesiastics, and judges; which neither is in practice, nor is supposed to be in theory, a general council of the realm. 2 Origin not certainly known.

In England, however, this general council hath been held immemorially, under the several names of *michel-synoth*, or "great council;" *michel-gemote*, or "great meeting;" and more frequently *wittena-gemote*, or "the meeting of wise men." It was also styled in Latin, *commune concilium regni*, *magnum concilium regis*, *curia magna*, *conventus magnatum vel procerum*, *assisa generalis*, and sometimes *communitas regni Angliæ*. We have instances of its meeting to order the affairs of the kingdom, to make new laws, and to amend the old, or, as Fleta expresses it, *novis injuriis emersis nova constituere remedia*, so early as the reign of Ina king of the West Saxons, Offa king of the Mercians, and Ethelbert king of Kent, in the several realms of the heptarchy. And after their union, the Mirrour informs us, that King Alfred ordained for a perpetual usage, that these coun- 3 Antiquity of, in England.

cils should meet twice in the year, or oftener, if need be, to treat of the government of God's people; how they should keep themselves from sin, should live in quiet, and should receive right. Our succeeding Saxon and Danish monarchs held frequent councils of this sort, as appears from their respective codes of laws; the titles whereof usually speak them to be enacted, either by the king with the advice of his *wittena-gemote*, or wise men, as, *Hæc sunt instituta, quæ Edgarus rex consilio sapientium suorum instituit;* or to be enacted by those sages with the advice of the king: as *Hæc sunt judicia quæ sapientes consilio regis Ethelstam instituerunt;* or, lastly, To be enacted by them both together, as *Hæ sunt institutiones, quas rex Edmundus et episcopi sui cum sapientibus suis instituerunt.*

There is also no doubt but these great councils were occasionally held under the first princes of the Norman line. Glanvil, who wrote in the reign of Henry II. speaking of the particular amount of an amercement in the sheriff's court, says, it had never yet been ascertained by the general assize or assembly, but was left to the custom of particular counties. Here the general assize is spoken of as a meeting well known, and its statutes or decisions are put in a manifest contradistinction to custom, or to the common law. And in Edward III.'s time, an act of parliament, made in the reign of William the Conqueror, was pleaded in the case of the abbey of St Edmund's Bury, and judicially allowed by the court.

4
The nature of these early parliaments not easily known.

Hence it indisputably appears, that parliaments, or general councils, are coeval with the kingdom itself. How those parliaments were constituted and composed, is another question, which has been matter of great dispute among our learned antiquarians; and particularly, whether the commons were summoned at all; or, if summoned, at what period they began to form a distinct assembly. But without entering into controversies of this sort, it may be sufficient to observe, that it is generally agreed, that in the main the constitution of parliament, as it now stands, was marked out so long ago as the 17th year of King John, A. D. 1215, in the great charter granted by that prince; wherein he promises to summon all archbishops, bishops, abbots, earls, and greater barons, personally; and all other tenants in chief under the crown, by the sheriff and bailiffs; to meet at a certain place, with 40 days notice, to assess aids and scutages when necessary. And this constitution has subsisted in fact at least from the year 1266, 49 Henry III. there being still extant writs of that date, to summon knights, citizens, and burgesses, to parliament. We proceed therefore to inquire wherein consists this constitution of parliament, as it now stands, and has stood, for the space of at least 500 years. And in the prosecution of this inquiry, we shall consider, first, The manner and time of its assembling: Secondly, Its constituent parts: Thirdly, The laws and customs relating to parliament: Fourthly, The methods of proceeding, and of making statutes, in both houses: And, lastly, The manner of the parliament's adjournment: prorogation, and dissolution.

5
Parliament summoned only by the king.

I. *As to the manner and time of assembling.* The parliament is regularly to be summoned by the king's writ or letter, issued out of chancery by advice of the privy council, at least 40 days before it begins to sit. It is a branch of the royal prerogative, that no parliament can be convened by its own authority, or by the authority of any except the king alone. And this prerogative is founded upon very good reason. For, supposing it had a right to meet spontaneously, without being called together, it is impossible to conceive that all the members, and each of the houses, would agree unanimously upon the proper time and place of meeting; and if half of the members met, and half absented themselves, who shall determine which is really the legislative body, the part assembled, or that which stays away? It is therefore necessary, that the parliament should be called together at a determinate time and place; and, highly becoming its dignity and independence, that it should be called together by none but one of its own constituent parts: and of the three constituent parts, this office can only appertain to the king; as he is a single person, whose will may be uniform and steady; the first person in the nation, being superior to both houses in dignity; and the only branch of the legislature that has a separate existence, and is capable of performing any act at a time when no parliament is in being. Nor is it an exception to this rule, that, by some modern statutes, on the demise of a king or queen, if there be then no parliament in being, the last parliament revives, and is to sit again for six months, unless dissolved by the successor: for this revived parliament must have been originally summoned by the crown.

6
The convention parliaments no just exception to this;

It is true, that the convention parliament which restored King Charles II. met above a month before his return; the lords, by their own authority, and the commons in pursuance of writs issued in the name of the keepers of the liberty of England by authority of parliament, and that the said parliament sat till the 29th of December, full seven months after the Restoration; and enacted many laws, several of which are still in force. But this was for the necessity of the thing, which supersedes all law; for if they had not so met, it was morally impossible that the kingdom should have been settled in peace. And the first thing done after the king's return was, to pass an act declaring this to be a good parliament, notwithstanding the defect of the king's writ. So that as the royal prerogative was chiefly wounded by their so meeting, and as the king himself, who alone had a right to object, consented to wave the objection, this cannot be drawn into an example in prejudice of the rights of the crown. Besides, we should also remember, that it was at that time a great doubt among the lawyers, whether even this healing act made it a good parliament, and held by very many in the negative; though it seems to have been too nice a scruple. And yet, out of abundant caution, it was thought necessary to confirm its acts in the next parliament, by statute 13 Car. II c 7. and c. 14.

7
nor that of 1688, because they originated *ex necessitate rei.*

It is likewise true, at the time of the Revolution A. D. 1688, the lords and commons by their own authority, and upon the summons of the prince of Orange (afterwards King William), met in a convention, and therein disposed of the crown and kingdom. But it must be remembered, that this assembling was upon a like principle of necessity as at the Restoration; that is, upon a full conviction that King James II had abdicated the government, and that the throne was thereby vacant; which supposition of the individual members was confirmed by their concurrent resolution, when they actually came together. And in such a case as the palpable vacancy of a throne, it follows, *ex necessitate rei*, that the form, Parliament

form of the royal writs must be laid aside, otherwise no parliament can ever meet again. For let us put another possible case, and suppose, for the sake of argument, that the whole royal line should at any time fail, and become extinct, which would indisputably vacate the throne: in this situation it seems reasonable to presume, that the body of the nation, consisting of lords and commons, would have a right to meet and settle the government at all. And upon this and no other principle did the convention in 1688 assemble. The vacancy of the throne was precedent to their meeting without any royal summons, not a consequence of it. They did not assemble without writ, and then make the throne vacant; but, the throne being previously vacant by the king's abdication, they assembled without writ, as they must do if they assembled at all. Had the throne been full, their meeting would not have been regular; but, as it was really empty, such meeting became absolutely necessary. And accordingly, it is declared by statute 1 W. & M. stat. 1. c. 1. that this convention was really the two houses of parliament, notwithstanding the want of writs or other defects of form. So that, notwithstanding these two capital exceptions, which were justifiable only on a principle of necessity (and each of which, by the way, induced a revolution in the government), the rule laid down is in general certain, that the king only can convoke a parliament.

8 The king is obliged to convoke parliament as often as circumstances require.

And this, by the ancient statutes of the realm, he is bound to do every year, or oftener if need be. Not that he is, or ever was, obliged by these statutes to call a new parliament every year; but only to permit a parliament to sit annually for the redress of grievances, and dispatch of business, if need be. These last words are so loose and vague, that such of our monarchs as were inclined to govern without parliaments, neglected the convoking them, sometimes for a very considerable period, under pretence that there was not need of them. But, to remedy this, by the statute 16 Car. II. c. 1. it is enacted, that the sitting and holding of parliaments shall not be intermitted above three years at the most. And by the statute 1 W. and M. st. 2. c. 2. it is declared to be one of the rights of the people, that for redress of all grievances, and for the amending, strengthening, and preserving, the laws, parliaments ought to be held frequently. And this indefinite frequency is again reduced to a certainty by statute 6 W. & M. c. 2. which enacts, as the statute of Charles II. has done before, that a new parliament shall be called within three years after the determination of the former.

9 The king, lords spiritual and temporal, and commons, make the parliament.

II. *The constituent parts of a parliament are*, the king's majesty, sitting there in his royal political capacity, and the three estates of the realm; the lords spiritual, the lords temporal (who sit together with the king in one house), and the commons, who sit by themselves in another. And the king and these three estates together form the greater corporation or body politic of the kingdom, of which the king is said to be *caput, principium, et finis*. For upon their coming together the king meets them, either in person or by representation; without which there can be no beginning of a parliament; and he also has alone the power of dissolving them.

It is highly necessary for preserving the balance of the constitution, that the executive power should be a branch, though not the whole, of the legislature. The total union of them, we have seen, would be productive of tyranny: the total disjunction of them for the present, would in the end produce the same effects, by causing that union against which it seems to provide. The legislature would soon become tyrannical, by making continual encroachments, and gradually assuming to itself the rights of the executive power. Thus the long parliament of Charles I. while it acted in a constitutional manner, with the royal concurrence, redressed many heavy grievances and established many salutary laws. But when the two houses assumed the power of legislation, in exclusion of the royal authority, they soon after assumed likewise the reins of administration; and, in consequence of these united powers, overturned both church and state, and established a worse oppression than any they pretended to remedy. To hinder therefore any such encroachments, the king is himself a part of the parliament; and as this is the reason of his being so, very properly therefore the share of legislation which the constitution has placed in the crown, consists in the power of rejecting, rather than resolving; this being sufficient to answer the end proposed. For we may apply to the royal negative, in this instance, what Cicero observes of the negative of the Roman tribunes, that the crown has not any power of doing wrong, but merely of preventing wrong from being done. The crown cannot begin of itself any alterations in the present established law; but it may approve or disapprove of the alterations suggested and consented to by the two houses. The legislature therefore cannot abridge the executive power of any rights which it now has by law, without its own consent; since the law must perpetually stand as it now does, unless all the powers will agree to alter it. And herein indeed consists the true excellence of the British government, that all the parts of it form a mutual check upon each other. In the legislature, the people are a check upon the nobility, and the nobility a check upon the people, by the mutual privilege of rejecting what the other has resolved; while the king is a check upon both, which preserves the executive power from encroachments. And this very executive power is again checked and kept within due bounds by the two houses, through the privilege they have of inquiring into, impeaching, and punishing the conduct (not indeed of the king, which would destroy his constitutional independence; but which is more beneficial to the public) of his evil and pernicious counsellors. Thus every branch of our civil polity supports and is supported, regulates and is regulated, by the rest: for the two houses naturally drawing in two directions of opposite interest, and the prerogative in another still different from them both, they mutually keep each other from exceeding their proper limits; while the whole is prevented from separation, and artificially connected together by the mixed nature of the crown, which is a part of the legislative, and the sole executive magistrate. Like three distinct powers in mechanics, they jointly impel the machine of government in a direction different from what either, acting by itself, would have done; but at the same time in a direction partaking of each, and formed out of all; a direction which constitutes the true line of the liberty and happiness of the community.

10 The propriety and necessity of the king's being a branch of the legislature

Having already considered these constituent parts of the

Parliament. the sovereign power, or parliament, each in a separate view, under the articles King, Lords, and Commons, to which the reader is referred, we proceed,

11
The power of parliament.

III. To examine the laws and customs relating to parliament, united together and considered as one aggregate body. The power and jurisdiction of parliaments, says Sir Edward Coke, is so transcendent and absolute, that it cannot be confined either for causes or persons within any bounds. And of this high court he adds, it may be truly said, *Si antiquitatem spectes, est vetustissima; si dignitatem, est honoratissima; si jurisdictionem, est capacissima.* It hath sovereign and uncontroulable authority in making, confirming, enlarging, restraining, abrogating, repealing, reviving, and expounding laws, concerning matters of all possible denominations, ecclesiastical or temporal, civil, military, maritime, or criminal: this being the place where that absolute despotic power, which must in all governments reside somewhere, is intrusted by the constitution of these kingdoms. All mischiefs and grievances, operations and remedies, that transcend the ordinary course of the laws, are within the reach of this extraordinary tribunal. It can regulate or new-model the succession to the crown; as was done in the reigns of Henry VIII. and William III. It can alter the established religion of the land; as was done in a variety of instances in the reigns of King Henry VIII. and his three children. It can change and create afresh even the constitution of the kingdom and of parliaments themselves; as was done by the act of Union, and the several statutes for triennial and septennial elections. It can, in short, do every thing that is not naturally impossible; and therefore some have not scrupled to call its power, by a figure rather too bold, the *omnipotence of parliament.* True it is, that what the parliament doth, no authority upon earth can undo. So that it is a matter most essential to the liberties of this kingdom, that such members be delegated to this important trust as are most eminent for their probity, their fortitude, and their knowledge; for it was a known apophthegm of the great lord treasurer Burleigh, "That England could never be ruined but by a parliament;" and, as Sir Matthew Hale observes, this being the highest and greatest court, over which none other can have jurisdiction in the kingdom, if by any means a misgovernment should anyway fall upon it, the subjects of this kingdom are left without all manner of remedy. To the same purpose, the President Montesquieu, though we trust too hastily, presages, that as Rome, Sparta, and Carthage, have lost their liberty and perished; so the constitution of England will in time lose its liberty, will perish: it will perish whenever the legislative power shall become more corrupt than the executive.

12
Mr Locke's opinion respecting this power.

It must be owned, that Mr Locke, and other theoretical writers, have held, that "there remains still inherent in the people a supreme power to remove or alter the legislature, when they find the legislature act contrary to the trust reposed in them: for when such trust is abused, it is thereby forfeited, and devolves to those who gave it." But however just this conclusion may be in theory, we cannot adopt it, or argue from it, under any dispensation of government at present actually existing. For this devolution of power, to the people at large, includes in it a dissolution of the whole form of government established by that people; reduces all the members to their original state of equality; and by annihilating the sovereign power, repeals all positive laws whatsoever before enacted. No human laws will therefore suppose a case, which at once must destroy all law, and compel men to build afresh upon a new foundation; nor will they make provision for so desperate an event, as must render all legal provisions ineffectual. So long therefore as the English constitution lasts, we may venture to affirm, that the power of parliament is absolute and without controul.

13
The qualifications of members.

In order to prevent the mischiefs that might arise, by placing this extensive authority in hands that are either incapable or else improper to manage it, it is provided by the custom and law of parliament, that no one shall sit or vote in either house, unless he be 21 years of age. This is also expressly declared by statute 7 & 8 W. III. c. 25.: with regard to the house of commons, doubts have arisen, from some contradictory adjudications, whether or not a minor was incapacitated from sitting in that house. It is also enacted by statute 7 Jac. I. c. 6. that no member be permitted to enter the house of commons till he hath taken the oath of allegiance before the lord steward or his deputy: and by 30 Car. II. st. 2. and 1 Geo. I. c. 13. that no member shall vote or sit in either house, till he hath, in the presence of the house, taken the oaths of allegiance, supremacy, and abjuration, and subscribed and repeated the declaration against transubstantiation, and invocation of saints, and the sacrifice of the mass. Aliens, unless naturalized, were likewise by the law of parliament incapable to serve therein: and now it is enacted, by statute 12 & 13 W. III. c. 2. that no alien, even though he be naturalized, shall be capable of being a member of either house of parliament. And there are not only these standing incapacities; but if any person is made a peer by the king, or elected to serve in the house of commons by the people, yet may the respective houses, upon complaint of any crime in such person, and proof thereof, adjudge him disabled and incapable to sit as a member: and this by the law and custom of parliament.

14
The customs of parliament which are not sanctioned by express laws.

For as every court of justice hath laws and customs for its direction, some the civil and canon, some the common law, others their own peculiar laws and customs; so the high court of parliament hath also its own peculiar law, called the *lex et consuetudo parliamenti;* a law which Sir Edward Coke observes is *ab omnibus quærenda, à multis ignorata, à paucis cognita.* It will not therefore be expected that we should enter into the examination of this law with any degree of minuteness; since, as the same learned author assures us, it is much better to be learned out of the rolls of parliament and other records, and by precedents and continual experience, than can be expressed by any one man. It will be sufficient to observe, that the whole of the law and custom of parliament has its original from this one maxim, "That whatever matter arises concerning either house of parliament, ought to be examined, discussed, and adjudged in that house to which it relates, and not elsewhere." Hence, for instance, the lords will not suffer the commons to interfere in the settling the election of a peer in Scotland; the commons will not allow the lords to judge of the election of a burgess; nor will either house permit the subordinate courts of law to examine the merits of either case. But the maxims upon

Parliament. upon which they proceed, together with the method of proceeding, rest entirely in the breast of the parliament itself; and are not defined and ascertained by any particular stated laws.

15
Its extensive privileges.

The privileges of parliament are likewise very large and indefinite; and therefore, when in 31st Hen. VI. the house of lords propounded a question to the judges concerning them, the chief justice, Sir John Fortescue, in the name of his brethren, declared, "That they ought not to make answer to that question; for it hath not been used aforetime, that the justices should in any wise determine the privileges of the high court of parliament; for it is so high and mighty in its nature, that it may make law; and that which is law, it may make no law; and the determination and knowledge of that privilege belong to the lords of parliament, and not to the justices." Privileges of parliament was principally established, in order to protect its members not only from being molested by their fellow-subjects, but also more especially from being oppressed by the power of the crown. If therefore all the privileges of parliament were once to be set down and ascertained, and no privilege to be allowed but what was so defined and determined, it were easy for the executive power to devise some new case not within the line of privilege, and under pretence thereof to harass any refractory member, and violate the freedom of parliament. The dignity and independence of the two houses are therefore in great measure preserved by keeping their privileges indefinite. Some, however, of the more notorious privileges of the members of either house are, privileges of speech, of person, of their domestics, and of their lands and goods. As to the first, privilege of speech, it is declared by the statute 1 W. and M. st. 2. c. 2. as one of the liberties of the people, "That the freedom of speech, and debates, and proceedings in parliament, ought not to be impeached or questioned in any court or place out of parliament." And this freedom of speech is particularly demanded of the king in person, by the speaker of the house of commons, at the opening of every new parliament. So likewise are the other privileges, of person, servants, lands, and goods; which are immunities as ancient as Edward the Confessor: in whose laws we find this precept, *ad synodos venientibus, sive summoniti sint, sive per se quid agendum habuerint, sit summa pax;* and so too in the old Gothic constitutions, *Extenditur hæc pax et securitas ad quatuordecim dies, convocato regni senatu.* This included formerly not only privilege from illegal violence, but also from legal arrests and seizures by process from the courts of law. And still to assault by violence a member of either house, or his menial servants, is a high contempt of parliament, and there punished with the utmost severity. It has likewise peculiar penalties annexed to it in the courts of law by the statutes 5 Hen. IV. c. 6. and 11 Hen. VI. c. 11. Neither can any member of either house be arrested and taken into custody without a breach of the privilege of parliament.

16
Some privileges abolished.

But all other privileges which derogate from the common law are now at an end, save only as to the freedom of the member's person; which in a peer (by the privilege of peerage) is for ever sacred and inviolable; and in a commoner (by the privilege of parliament) for forty days after every prorogation, and forty days before the next appointed meeting; which is now in effect as long as the parliament subsists, it seldom being prorogued for more than 80 days at a time. As to all other privileges which obstruct the ordinary course of justice, they were restrained by the statutes 12 W. III. c. 3. 2 and 3 Ann. c. 18. and 11 Geo. II. c. 24. and are now totally abolished by statute 10 G. III. c. 50.; which enacts, that any suit may at any time be brought against any peer or member of parliament, their servants, or any other person entitled to privilege of parliament; which shall not be impeached or delayed by pretence of any such privilege, except that the person of a member of the house of commons shall not thereby be subjected to any arrest or imprisonment. Likewise, for the benefit of commerce, it is provided by statute 4 Geo. III. c. 33. that any trader, having privilege of parliament, may be served with legal process for any just debt (to the amount of 100l.): and unless he makes satisfaction within two months, it shall be deemed an act of bankruptcy; and that commissions of bankruptcy may be issued against such privileged traders in like manner as against any other. 17

Members may be arrested; but parliament must be informed of it, and of the case, &c.

The only way by which courts of justice could anciently take cognizance of privilege of parliament was by writ of privilege, in the nature of a *supersedeas*, to deliver the party out of custody when arrested in a civil suit. For when a letter was written by the speaker to the judges, to stay proceedings against a privileged person, they rejected it as contrary to their oath of office. But since the statute 12 Will. III. c. 3. which enacts, that no privileged person shall be subject to arrest or imprisonment, it hath been held, that such arrest is irregular *ab initio*, and that the party may be discharged upon motion. It is to be observed, that there is no precedent of any such writ of privilege, but only in civil suits; and that the statute of 1 Jac. I. c. 13. and that of King William (which remedy some inconveniences arising from privilege of parliament), speak only of civil actions. And therefore the claim of privilege hath been usually guarded with an exception as to the case of indictable crimes; or, as it hath been frequently expressed, of treason, felony, and breach (or surety) of the peace. Whereby it seems to have been understood, that no privilege was allowable to the members, their families, or servants, in any *crime*, whatsoever: for all crimes are treated by the law as being *contra pacem domini regis*. And instances have not been wanting, wherein privileged persons have been convicted of misdemeanors, and committed, or prosecuted to outlawry, even in the middle of a session; which proceeding has afterwards received the sanction and approbation of parliament. To which may be added, that a few years ago, the case of writing and publishing seditious libels was resolved by both houses not to be entitled to privilege; and that the reasons upon which that case proceeded, extended equally to every indictable offence. So that the chief, if not the only, privilege of parliament in such cases, seems to be the right of receiving immediate information of the imprisonment or detention of any member, with the reason for which he is detained: a practice that is daily used upon the slightest military accusations, preparatory to a trial by a court-martial; and which is recognised by the several temporary statutes for suspending the *habeas corpus* act: whereby it is provided, that no member of either house shall be detained, till the matter of which he stands suspected be first communicated to the house of which he is a member, and the consent of the said

Parliament. said house obtained for his commitment or detaining. But yet the usage has uniformly been, ever since the Revolution, that the communication has been subsequent to the arrest.

These are the general heads of the laws and customs relating to parliament, considered as one aggregate body. The laws and customs relating to each branch in particular being explained under the articles already referred to, viz. KING, LORDS, and COMMONS, we should proceed, IV. To the method of making laws; which is much the same in both houses. But for this, too, we have to refer the reader to the article BILL; and shall only observe in this place, that for despatch of business, each house of parliament has its speaker. The speaker of the house of lords, whose office it is to preside there, and manage the formality of business, is the lord chancellor, or keeper of the king's great seal, or any other appointed by the king's commission: and if none be so appointed, the house of lords (it is said) may elect.—The speaker of the house of commons is chosen by the house; but must be approved by the king. And herein the usage of the two houses differs, that the speaker of the house of commons cannot give his opinion or argue any question in the house; but the speaker of the house of lords, if a lord of parliament, may. In each house the act of the majority binds the whole; and this majority is declared by votes openly and publicly given; not, as at Venice, and many other senatorial assemblies, privately, or by ballot. This latter method may be serviceable, to prevent intrigues and unconstitutional combinations; but it is impossible to be practised with us, at least in the house of commons, where every member's conduct is subject to the future censure of his constituents, and therefore should be openly submitted to their inspection.

18 Of the lord chancellor and speaker of the house of commons.

19 Of the adjournment of parliament.

V. There remains only, in the last place, to add a word or two concerning the manner in which parliament may be *adjourned*, *prorogued*, or *dissolved*.

An *adjournment* is no more than a continuance of the session from one day to another; as the word itself signifies; and this is done by the authority of each house separately every day; and sometimes for a fortnight or a month together, as at Christmas or Easter, or upon other particular occasions. But the adjournment of one house is no adjournment of the other. It hath also been usual, when his majesty hath signified his pleasure, that both or either of the houses should adjourn themselves to a certain day, to obey the king's pleasure so signified, and to adjourn accordingly.—Otherwise, besides the indecorum of a refusal, a prorogation would assuredly follow; which would often be very inconvenient to both public and private business. For prorogation puts an end to the session; and then such bills as are only begun, and not perfected, must be resumed *de novo* (if at all) in a subsequent session; whereas, after an adjournment, all things continue in the same state as at the time of the adjournment made, and may be proceeded on without any fresh commencement.

20 Of prorogation of parliament.

A *prorogation* is the continuance of the parliament from one session to another; as an adjournment is a continuation of the session from day to day. This is done by the royal authority, expressed either by the lord chancellor in his majesty's presence, or by commission from the crown, or frequently by proclamation. Both houses are necessarily prorogued at the same time; it not being a prorogation of the house of lords or commons, but of the parliament. The session is never understood to be at an end until a prorogation; though, unless some act be passed, or some judgment given in parliament, it is in truth no session at all. And formerly the usage was, for the king to give the royal assent to all such bills as he approved at the end of every session, and then to prorogue the parliament, though sometimes only for a day or two; after which all business then depending in the houses was to be begun again. Which custom obtained so strongly, that it once became a question, Whether giving the royal assent to a single bill did not of course put an end to the session? And though it was then resolved in the negative, yet the notion was so deeply rooted, that the statute 1 Car. I. c. 7. was passed to declare, that the king's assent to that and some other acts should not put an end to the session; and even so late as the reign of Charles II. we find a proviso frequently tacked to a bill, that his majesty's assent thereto should not determine the session of parliament. But it now seems to be allowed, that a prorogation must be expressly made, in order to determine the session. And if at the time of an actual rebellion, or imminent danger of invasion, the parliament shall be separated by adjournment or prorogation, the king is empowered to call them together by proclamation, with 14 days notice of the time appointed for their reassembling.

A *dissolution* is the civil death of the parliament; and this may be effected three ways: 1. By the king's will, expressed either in person or by representation. For as the king has the sole right of convening the parliament, so also it is a branch of the royal prerogative, that he may (whenever he pleases) prorogue the parliament for a time, or put a final period to its existence. If nothing had a right to prorogue or dissolve a parliament but itself, it might happen to become perpetual. And this would be extremely dangerous if at any time it should attempt to encroach upon the executive power, as was fatally experienced by the unfortunate King Charles I.; who, having unadvisedly passed an act to continue the parliament then in being till such time as it should please to dissolve itself, at last fell a sacrifice to that inordinate power which he himself had consented to give them. It is therefore extremely necessary that the crown should be empowered to regulate the duration of these assemblies, under the limitations which the English constitution has prescribed: so that, on the one hand, they may frequently and regularly come together for the despatch of business and redress of grievances; and may not, on the other, even with the consent of the crown, be continued to an inconvenient or unconstitutional length.

21 Parliament is dissolved by the king's will,

2. A parliament may be dissolved by the demise of the crown. This dissolution formerly happened immediately upon the death of the reigning sovereign: for he being considered in law as the head of the parliament, (*caput, principium, et finis*), that failing, the whole body was held to be extinct. But the calling a new parliament immediately on the inauguration of the successor being found inconvenient, and dangers being apprehended from having no parliament in being in case of a disputed succession, it was enacted by the statutes 7 and 8 Wm. III. c. 15. and 6 Ann. c. 7. that the parliament in being shall continue for six months after the death of any king or queen, unless sooner prorogued or dissolved

22 or in consequence of his death,

Parliament. ved by the successor; that if the parliament be, at the time of the king's death, separated, by adjournment or prorogation, it shall notwithstanding assemble immediately: and that if no parliament is then in being, the members of the last parliament shall assemble and be again a parliament.

23 or through length of time.

4. Lastly, A parliament may be dissolved or expire by length of time. For if either the legislative body were perpetual, or might last for the life of the prince who convened them as formerly, and were so to be supplied, by occasionally filling the vacancies with new representatives; in these cases, if it were once corrupted, the evil would be past all remedy; but when different bodies succeed each other, if the people see cause to disapprove of the present, they may rectify its faults in the next. A legislative assembly also, which is sure to be separated again, (whereby its members will themselves become private men, and subject to the full extent of the laws which they have enacted for others), will think themselves bound in interest as well as duty, to make only such laws as are good. The utmost extent of time that the same parliament was allowed to sit, by the statute 6 W. and M. c. 3. was *three* years: after the expiration of which, reckoning from the return of the first summons, the parliament was to have no longer continuance. But by the statute 1 Geo. I. stat. 2. c. 38. (in order, professedly, to prevent the great and continued expences of frequent elections, and the violent heats and animosities consequent thereupon, and for the peace and security of the government then just recovering from the late rebellion), this term was prolonged to *seven* years; and, what alone is an instance of the vast authority of parliament, the very same house that was chosen for three years, enacted its own continuance for seven. So that, as our constitution now stands, the parliament must expire, or die a natural death, at the end of every seventh year, if not sooner dissolved by the royal prerogative.

We shall conclude this article with an account of some general forms not taken notice of under any of the above heads.

24 General forms observed in the house of peers.

In the house of lords, the princes of the blood sit by themselves on the sides of the throne; at the wall, on the king's right hand, the two archbishops sit by themselves on a form. Below them, the bishops of London, Durham, and Winchester, and all the other bishops, sit according to the priority of their consecration. On the king's left hand the lord treasurer, lord president, and lord privy seal, sit upon forms above all dukes, except the royal blood; then the dukes, marquises, and earls, according to their creation. Across the room are wool sacks, continued from an ancient custom; and the chanceller, or keeper, being of course the speaker of the house of lords, sits on the first wool sack before the throne, with the great seal or mace lying by him; below these are forms for the viscounts and barons. On the other wool sacks are seated the judges, masters in chancery, and king's council, who are only to give their advice in points of law; but they all stand up till the king gives them leave to sit.

25 In the house of commons.

The commons sit promiscuously; only the speaker has a chair at the upper end of the house, and the clerk and his assistant sit at a table near him.

When a member of the house of commons speaks, he stands up uncovered, and directs his speech to the speaker only. If what he says be answered by another, he is not allowed to reply the same day, unless personal reflections have been cast upon him: but when the commons, in order to have a greater freedom of debate, have resolved themselves into a committee of the whole house, every member may speak to a question as often as he thinks necessary. In the house of lords they vote, beginning at the puisne or lowest baron, and so up orderly to the highest, every one answering *Content* or *Not content.* In the house of commons they vote by *yeas* and *nays;* and if it be dubious which are the greater number, the house divides. If the question be about bringing any thing into the house, the *yeas* go out, but if it be about any thing the house already has, the *nays* go out. In all divisions the speaker appoints four tellers, two of each opinion. In a committee of the whole house, they divide by changing sides, the *yeas* taking the right and the *nays* the left of the chair; and then there are but two tellers. If a bill pass one house, and the other demur to it, a conference is demanded in the painted chamber, where certain members are deputed from each house; and here the lords sit covered, and the commons stand bare, and debate the case. If they disagree, the affair is null: but if they agree, this, with the other bills that have passed both houses, is brought down to the king in the house of lords, who comes thither clothed in his royal robes; before him the clerk of the parliament reads the title of each bill, and as he reads, the clerk of the crown pronounces the royal assent or dissent. 26

Manner of expressing the royal assent or dissent to bills.

If it be a public bill, the royal assent is given in these words, *Le roy le veut,* "The king will have it so;" if private, *Soit fait comme il est desiré,* "Let the request be complied with;" if the king refuses the bill, the answer is, *Le roy s'avisera,* "The king will think of it;" and if it be a money bill, the answer is, *Le roy remercie ses loyaux sujets, accepte leur benevolence, et aussi le veut;* "The king thanks his loyal subjects, accepts their benevolence, and therefore grants his consent."

High Court of PARLIAMENT, is the supreme court in the kingdom, not only for the making, but also for the execution of laws; by the trial of great and enormous offenders, whether lords or commoners, in the method of parliamentary impeachment. As for acts of parliament to attaint particular persons of treason or felony, or to inflict pains and penalties, beyond or contrary to the common law, to serve a special purpose, we speak not of them; being to all intents and purposes new laws, made *pro re nata,* and by no means an execution of such as are already in being. But an impeachment before the lords by the commons of Great Britain, in parliament, is a prosecution of the already known and established law, and has been frequently put in practice; being a presentment to the most high and supreme court of criminal jurisdiction by the most solemn grand inquest of the whole kingdom. A commoner cannot, however, be impeached before the lords for any capital offence, but only for high misdemeanors; a peer may be impeached for any crime. And they usually (in case of an impeachment of a peer for treason) address the crown to appoint a lord high steward, for the greater dignity and regularity of their proceedings; which high steward was formerly elected by the peers themselves, though he was generally commissioned by the king; but it hath of late years been strenuously maintained, that the appointment

Parliament. ment of a high steward in such cases is not indispensably necessary, but that the house may proceed without one. The articles of impeachment are a kind of bills of indictment, found by the house of commons, and afterwards tried by the lords; who are in cases of misdemeanors considered not only as their own peers, but as the peers of the whole nation. This is a custom derived to us from the constitution of the ancient Germans; who in their great councils sometimes tried capital accusations relating to the public: *Licet apud concilium accusare quoque, et discrimen capitis intendere*. And it has a peculiar propriety in the English constitution; which has much improved upon the ancient model imported hither from the continent. For though in general the union of the legislative and judicial powers ought to be most carefully avoided, yet it may happen that a subject, intrusted with the administration of public affairs, may infringe the rights of the people, and be guilty of such crimes as the ordinary magistrate either dares not or cannot punish. Of these the representatives of the people, or house of commons, cannot properly judge; because their constituents are the parties injured, and can therefore only impeach. But before what court shall this impeachment be tried? Not before the ordinary tribunals, which would naturally be swayed by the authority of so powerful an accuser. Reason therefore will suggest, that this branch of the legislature, which represents the people, must bring its charge before the other branch; which consists of the nobility, who have neither the same interests, nor the same passions, as popular assemblies. This is a vast superiority which the constitution of this island enjoys over those of the Grecian or Roman republics; where the people were at the same time both judges and accusers. It is proper that the nobility should judge, to ensure justice to the accused; as it is proper that the people should accuse, to ensure justice to the commonwealth. And therefore, among other extraordinary circumstances attending the authority of this court, there is one of a very singular nature, which was insisted on by the house of commons in the case of the earl of Danby in the reign of Chas. II. and is now enacted by statute 12 and 13 W. III. c. 2. that no pardon under the great seal shall be pleadable to an impeachment by the commons of Great Britain in parliament.

Such is the nature of a British parliament, and in theory at least we should presume it were nearly perfect; but some of our fellow countrymen, more zealous perhaps than wise, see prodigious faults in it, such indeed as they think must inevitably prove fatal. The consequence of this persuasion, has been a loud and incessant call for parliamentary reform. That abuses ought to be reformed, is certain; and that few institutions are so perfect as not to need amendment, is a fact equally indisputable. We shall even suppose that there are many abuses in our parliament which would require to be amended; but, granting all this, and something more if it were necessary, we would recommend in the mean time to the serious consideration of those who call themselves the *Friends of the People*, whose sincerity in their professions it would be unpolite to question, the example of France, and that they would allow it to be a warning to Britain. France wanted reform indeed, and that which was first proposed had the countenance of the coolest and the best of men; but the consequences have been dreadful; and if ever a free and stable government take place in it, which we sincerely wish may be soon, it will have been purchased at an immense price, by enormities which will disgrace it whilst the remembrance of them lasts.

The former *PARLIAMENTS of France* were sovereign courts established by the king, finally to determine all disputes between particular persons, and to pronounce on appeals from sentences given by inferior judges.—There were ten of these parliaments in France, of which that of Paris was the chief, its privileges and jurisdiction being of the greatest extent. It consisted of eight chambers: the grand chamber, where causes of audience were pleaded; the chamber of written law; the chamber of counsel; the Tournelle criminelle, for judging criminal affairs; the Tournelle civile, in aid of the grand chamber; and three chambers of inquests, where processes were adjudged in writing: besides these, there were also the chamber of vacations, and those of requests. In 1771 the king thought fit to branch the parliament of Paris into six different parliaments, under the denomination of superior courts, each parliament having similar jurisdiction. Under their second race of kings, this parliament, like that of England, was the king's council; it gave audience to ambassadors, and consulted of the affairs of war and government. The king, like ours, at that time presided in them, without being at all master of their resolutions. But in after times their authority was abridged; as the kings reserved the decision of the grand affairs of the public to their own councils; leaving none but private ones to the parliaments. The parliament of Paris also enjoyed the privileges of verifying and registering the king's arrets or edicts, without which those edicts were of little or no value.

PARLIAMENT of Sweden, consists of four estates, with the king at their head. These estates are, 1. The nobility and representatives of the gentry; with whom the colonels, lieutenant colonels, majors, and captains of every regiment, sit and vote. 2. The clergy; one of which body is elected from every rural deanery of ten parishes; who, with the bishops and superintendents, amount to about 200. 3. The burghers, elected by the magistrates and council of every corporation as their representatives, of whom there are four for Stockholm, and two for every other town, amounting in the whole to about 150. 4. The peasants, chosen by the peasants out of every district; who choose one of their own rank, and not a gentleman, to represent them: these amount to about 250.

All these generally meet at Stockholm: and after the state affairs have been represented to them from the throne, they separate, and sit in four several chambers or houses, in each of which affairs are carried on by majority of votes; and every chamber has a negative in the passing any law.

Parma. PARMA, an ancient, rich, populous, and handsome town of Italy, capital of the duchy of the same name, with a citadel, a bishop's see, and an university. The number of inhabitants is about 36,000. It has a magnificent cathedral, and the largest opera house in Europe, which has seats for 8000 people; but as it required a vast number of candles, which occasioned great expence, they have contrived another which has room for 2000 spectators. The dome and the church of St John are painted by the famous Corregio, who was a native of of this place. The citadel, which is very near the city, is built in the same taste as that at Antwerp. In 1734 there was a bloody battle fought here; and in 1741, by the treaty of Aix-la-Chapelle, the duchies of Parma, Placentia, and Guastalla, were given to Don Philip, brother to Don Carlos above mentioned. In 1814 these duchies were bestowed upon Maria Louisa late empress of France, with the right of succession to her son Napoleon Charles. It is 30 miles south-east of Cremona, and 60 south east of Milan. E. Long. 10. 51. N. Lat. 44. 50.

Parma, the duchy of, a province of Italy, bounded on the north by the Po; on the north-east by the Mantuan; on the east by the duchy of Modena; on the south by Tuscany; and on the west by the duchy of Placentia. The air is very wholesome, on which account the inhabitants live to a great age. The soil is very fertile in corn, wine, oil, and hemp; the pastures feed a great number of cattle, and the cheese is in very high esteem. Here are considerable mines of copper and silver.

PARMESAN cheese, a sort of cheese much esteemed among the Italians; so named from the duchy of Parma where it is made, and whence it is conveyed to various parts of Europe.

The excellent pasture grounds of this country are watered by the Po; and the cows from whose milk this cheese is made yield a great quantity of it. Of this cheese there are three sorts; the *fromaggio di forma*, about two palms in diameter, and seven or eight inches thick; and the *fromaggia di ribiole* and *di ribolini*, which are not so large. This cheese is of a saffron colour; and the best is kept three or four years. See Cheese.

PARMIGIANO, a celebrated painter, whose true name was Francesco Mazzuoli; but he received the former from the city of Parma, where he was born, in 1504. He was brought up under his two uncles, and was an eminent painter when but 16 years of age. He was famous all over Italy at 19; and at 23 performed such wonders, that when the general of the emperor Charles V. took Rome by storm, some of the common soldiers having, in sacking the town, broke into his apartments, found him intent upon his work, and were instantly so struck with the beauty of his pieces, that instead of involving him in the plunder and destruction in which they were then employed, they resolved to protect him from all manner of violence; which they actually performed. His works are distinguished by the beauty of the colouring, the invention, and drawing. His figures are spirited and graceful, particularly with respect to the choice of attitude, and in their dresses. He also excelled in music, in which he much delighted.

In large compositions Parmigiano did not always reach a high degree of excellence; but in his holy families, and other similar subjects, the gracefulness of his heads, and the elegance of his attitudes, are peculiarly delightful. For the celebrity of his name he seems to be chiefly indebted to his numerous drawings and etchings; for his life being short, and a great part of it consumed in the idle study of alchemy, in pursuit of the philosopher's stone, and in the seducing avocations of music and gambling, there was but little time left for application to the laborious part of his business. His paintings in oil are few in number, and held in high esteem, as are also his drawings and etchings; good impressions of these last being very rarely to be found. He was the first that practised the art of etching in Italy; and probably he did not at first know, that it had been for some years practised in Germany. When he set out for Rome, he was advised to take some of his pictures with him, as a means of getting himself introduced into the acquaintance of the nobility and artists in that celebrated city. One of them is mentioned by his biographers as a masterpiece. It was his own portrait painted upon a piece of wood of a convex form, in imitation of a convex mirror. The surface is said to have been so wonderfully executed, that it had the appearance of real glass, and the head, as well as every part of the furniture of the chamber in which he was supposed to sit, was so artfully managed, that the whole formed a very complete piece of deception. At Rome he was employed by Pope Clement VII. who was highly pleased with his performances, and rewarded him liberally. A Circumcision which he painted for him was particularly esteemed as a capital work. In it Parmigiano was successful in introducing a variety of lights, without destroying the general harmony. When Charles V. came to Bologna to be crowned emperor of the Romans, Parmigiano failed not to be present at that singular ceremony; and so accurately marked the countenance of the emperor, that at his return home, he was enabled from memory to make out a surprising likeness. In the same piece he introduced the figure of Fame placing a crown of laurel on the head of the emperor, whilst a young Hercules presented him with a globe of the world. Before it was quite finished, the painter and his piece were introduced to Charles by the Pope, but to little purpose; for the emperor left Bologna a few days after, without ordering him any recompense for his labour. In the church of Madona della Stercato at Parma are still to be seen several of the works of this artist; among which one of Sibyls, and two others of Moses, and of Adam and Eve, are much admired. So also is a Dead Christ, with the Virgin in sorrow, in the church of the Dominicans at Cremona. In the Houghton collection of pictures, now in possession of the empress of Russia, is one of his best pictures, representing Christ laid in the sepulchre, for which he is said to have been knighted by the duke of Parma. His principal works are at Parma, where he died poor in 1540.

PARNASSIA, grass of Parnassus; a genus of plants belonging to the pentandria class. See Botany *Index*.

PARNASSUS (Strabo, Pindar, Virgil), a mountain of Phocis, near Delphi, and the mounts Cithæron and Helicon, with two tops (Ovid, Lucan); the one called *Cirrha*, sacred to Apollo; and the other *Nisa*, sacred to Bacchus, (Juvenal). It was covered with bay trees (Virgil); and originally called *Larnassus*, from Deucalion's larnax or ark, thither conveyed by the flood, (Stephanus, Scholiast on Apollonius); after the flood, *Parnassus;* from Har Nahas, changing the *h* into *p*, the hill of divination or augury (Peucerus); the oracle of Delphi standing at its foot.

Chandler *, who visited it, thus describes it:—"Parnassus was the western boundary of Phocis, and stretching northward from about Delphi toward the Oetæan mountains, separated the western Locri from those who possessed the sea coast before Eubœa. It was a place of refuge

* Travels in Greece.

Parnassus.

refuge to the Delphians in times of danger. In the deluge, which happened under Deucalion, the natives were saved on it by following the cry of wolves. On the invasion by Xerxes, some transported their families over to Achaia, but many concealed them in the mountain, and in Corycium, a grotto of the Nymphs. All Parnassus was renowned for sanctity, but Corycium was the most noted among the hallowed caves and places. 'On the way to the summit of Parnassus, says Pausanias, as much as 60 stadia beyond Delphi, is a brazen image; and from thence the ascent to Corycium is easier for a man on foot, and for mules and horses. Of all the caves in which I have been, this appeared to me the best worth seeing. On the coasts, and by the sea side, are more than can be numbered; but some are very famous both in Greece and in other countries. The Corycian cave exceeds in magnitude those I have mentioned, and for the most part may be passed through without a light. It is sufficiently high: and has water, some springing up, and yet more from the roof, which petrifies; so that the bottom of the whole cave is covered with sparry icicles. The inhabitants of Parnassus esteem it sacred to the Corycian Nymphs, and particularly to Pan.—From the cave to reach the summits of the mountain is difficult even to a man on foot. The summits are above the clouds, and the women called *Thyades* madden on them in the rites of Bacchus and Apollo.' Their frantic orgies were performed yearly. Wheler and his company ascended Parnassus from Delphi, some on horses, by a track between the stadium and the clefts of the mountain. Stairs were cut in the rock, with a strait channel, perhaps a water duct.—In a long hour, after many traverses, they gained the top, and entering a plain turned to the right, towards the summits of Castalia, which are divided by deep precipices. From this eminence they had a fine prospect of the gulf of Corinth, and of the coast; Mount Cirphis appearing beneath them as a plain, bounded on the east by the bay of Asprospitia, and on the west by that of Salona. A few shepherds had huts there. They returned to the way which they had quitted, and crossed a hill covered with pines and snow. On their left was a lake, and beyond it a peak, exceedingly high, white with snow. They travelled to the foot of it through a valley, four or five miles in compass; and rested by a plentiful fountain called *Drosonigo*, the stream boiling up a foot in diameter, and nearly as much above the surface of the ground. It runs into the lake, which is about a quarter of a mile distant to the south-east. They did not discover Corycium, or proceed farther on, but keeping the lake on their right, came again to the brink of the mountain, and descended by a deep and dangerous track to Racovi, a village four or five miles eastward from Delphi. It was the opinion of Wheler, that no mountain in Greece was higher than Parnassus; that it was not inferior to Mount Cenis among the Alps; and that, if detached, it would be seen at a greater distance than even Mount Athos. The summits are perpetually increasing, every new fall of snow adding to the perennial heap, while the sun has power only to thaw the superficies. Castalis, Pleistus, and innumerable springs are fed, some invisibly, from the lakes and reservoirs, which, without these drains and subterraneous vents, would swell, especially after heavy rains and the melting of snow, so as to fill the valleys, and run over the tops of the rocks down upon Delphi, spreading wide an inundation, similar, as has been surmised, to the Deucalionian deluge."

Parnassus || Parody.

PARNELL, Dr Thomas, a very ingenious divine and poet in the early part of the 18th century. He was archdeacon of Clogher, and the intimate friend of Mr Pope; who published his works, with an elegant copy of recommendatory verses prefixed. He died in 1718, aged 39.

Johnson † says, "The life of Dr Parnell is a task which I should very willingly decline, since it has been lately written by Goldsmith, a man of such variety of powers, and such facility of performance, that he always seemed to do best that which he was doing; a man who had the art of being minute without tediousness, and general without confusion; whose language was copious without exuberance, exact without constraint, and easy without weakness.

† *Lives of the Poets.*

"What such an author has told, who would tell again? I have made an extract from his larger narrative; and shall have this gratification from my attempt, that it gives me an opportunity of paying due tribute to the memory of a departed genius.

'Το γαρ γερας εστι θανοντων.'

"The general character of Parnell is not great extent of comprehension, or fertility of mind. Of the little that appears still less is his own. His praise must be derived from the easy sweetness of his diction: in his verses there is more happiness than pains; he is sprightly without effort, and always delights though he never ravishes; every thing is proper, yet every thing seems casual. If there is some appearance of elaboration in the Hermit, the narrative, as it is less airy, is less pleasing. Of his other compositions, it is impossible to say whether they are the productions of Nature so excellent as not to want the help of Art, or of Art so refined as to resemble Nature."

PARODICAL degrees, in an equation, a term sometimes used to denote the several regular terms in a quadratic, cubic, biquadratic, &c. equation, when the indices of the powers ascend or descend orderly in an arithmetical progression. Thus, $x^3+mx^2+nx=p$ is a cubic equation where no term is wanting, but having all its parodic degrees; the indices of the terms regularly descending thus, 3, 2, 1, 0.

PARODY, a popular maxim, adage, or proverb.

Parody, is also a poetical pleasantry, consisting in applying the verses written on one subject, by way of ridicule, to another; or in turning a serious work into a burlesque, by affecting to observe as near as possible the same rhimes, words, and cadences.

The parody was first set on foot by the Greeks; from whom we borrow the name. It comes near to what some of our late writers call *travesty*. Others have more accurately distinguished between a parody and burlesque; and they observe, that the change of a single word may parody a verse; or of a single letter a word. Thus, in the last case, Cato exposed the inconstant disposition of Marcus Fulvius Nobilior, by changing Nobilior into Mobilior. Another kind of parody consists in the mere application of some known verse, or part of a verse of a writer, without making any change in it, with a view to expose it. A fourth instance is that of writing verses in the taste and style of authors little approved.

proved. The rules of parody regard the choice of a subject, and the manner of treating it. The subject should be a known and celebrated work: as to the manner, it should be by an exact imitation, and an intermixture of good-natured pleasantry.

PAROLE, in a military sense, the promise made by a prisoner of war, when he has leave to go anywhere, of returning at a time appointed, if not exchanged.

PAROLE, means also a word given out every day in orders by the commanding officer, both in camp and garrison, in order to know friends from enemies.

PARONOMASIA, in *Rhetoric*, a pun; or a figure whereby words nearly alike in sound, but of very different meanings, are affectedly or designedly used. See ORATORY, N° 76.

PARONYCHIA, the WHITLOW, in *Surgery*, is an abscess at the end of the fingers. According as it is situated more or less deep, it is differently denominated, and divided into species. See SURGERY *Index*.

PAROS, in *Ancient Geography*, an island of the Ægean sea, one of the Cyclades, with a strong cognominal town, 38 miles distant from Delos (Pliny, Nepos). Anciently called *Pactye* and *Minoa* (Pliny); also *Demetrias*, *Zacynthus*, *Hyria*, *Hylcessa*, and *Cabarnis* (Nicanor). The country of Archilochus the iambic poet (Strabo). An island famous for its white marble (Virgil, Horace, Ovid), called *lychnites*, because dug with lamps (Pliny). The name of Cabarnis is borrowed, according to Stephanus, from one Cabarnus, who first informed Ceres of the rape of her daughter Proserpine; or, according to Hesychius, from the Cabarni, the priests of Ceres being so called by the inhabitants of this island. The name of Minoa is borrowed from Minos king of Crete, who subdued this, as he did most of the other islands of the Ægean sea. It was called Paros, which name it retains to this day, from Paros the son of Parrhasius, or as Stephanus will have it, of Jason the Argonaut. Paros, according to Pliny's computation, is distant from Naxos seven miles and a half, and 28 from Delos. Some modern travellers suppose that it is 80, others only 50 miles in compass. Pliny says it is half as large as Naxos, that is, between 36 and 37 miles in compass. It was a rich and powerful island, being termed the most wealthy and happy of the Cyclades, and by Cornelius Nepos an island elated with its riches. The city of Paros, the metropolis, is styled by Stephanus a potent city, and one of the largest in the Archipelago: the present city of Paros, now Parichia, is supposed to have been built upon its ruins, the country abounding with valuable monuments of antiquity. The very walls of the present city are built with columns, architraves, pedestals, mingled with pieces of ancient marble of a surprising magnitude, which were once employed in more noble edifices. Paros was indeed formerly famous for its marble, which was of an extraordinary whiteness, and in such request among the ancients that the best statuaries used no other (A). The island is provided with several capacious and safe harbours, and was anciently much resorted to by traders. It was, according to Thucydides, originally peopled by the Phœnicians, who were the first masters of the sea. Afterwards the Carians settled here, as we are told by Thucydides and Diodorus. But these two authors differ as to the time when the Carians came first into the island; for Thucydides tells us, that the Carians were driven out by the Cretans under the conduct of Minos; and Diodorus writes, that the Carians did not settle here till after the Trojan war, when they found the Cretans in possession of the island. Stephanus thinks that the Cretans, mixed with some Arcadians, were the only people that ever possessed this island. Minos himself, if we believe Pliny, resided some time in the island of Paros, and received here the melancholy news of the death of his son Androgeus, who was killed in Attica after he had distinguished himself at the public games. We find the inhabitants of this island chosen from among all the Greeks by the Milesians to compose the differences which had for two generations rent that unhappy state into parties and factions. They acquitted themselves with great prudence, and reformed the government. They assisted Darius in his expedition against Greece with a considerable squadron; but after the victory obtained by Miltiades at Marathon, they were reduced to great straits by that general. However, after blocking up the city for 26 days, he was obliged to quit the enterprise, and return to Athens with disgrace. Upon his departure, the Parians were informed that Timo, a priestess of the national gods, and then his prisoner, had advised him to perform some secret ceremony in the temple of Ceres, near the city; assuring him that he would thereby gain the place. Upon this information they sent deputies to consult the oracle of Delphi, whether they should punish her with death, for endeavouring to betray the city to the enemy, and discovering the sacred mysteries to Miltiades. The Pythian answered that Timo was not the adviser; but that the gods, having resolved to destroy Miltiades, had only made her the instrument of his death. After the battle of Salamis, Themistocles subjected Paros and most of the other neighbouring islands to Athens, exacting large sums from them by way of punishment for having favoured the Persians. It appears from the famous monument of Adulas, which Cosmos of Egypt has described with great exactness, that Paros and the other Cyclades were once subject to the Ptolemies of Egypt. However, Paros fell again under the power of the Athenians, who continued masters of it till they were driven out by Mithridates

(A) Sutherland says, "that while its marble quarries continued to be worked, Paros was one of the most flourishing of the Cyclades; but on the decline of the eastern empire they were entirely neglected, and are now converted into caves, in which the shepherds shelter their flocks. We have been in several of these subterraneous folds, which put me much in mind of Homer's description of Polyphemus. The common walls are almost entirely composed of marble; and in examining a very small part of one, we found several pieces of cornice and basso relievo. Several fine blocks of marble (fragments of columns) are lying close to the water's edge; and seem to have been brought there by travellers, who for want of a proper purchase to get them on board, have not been able to carry them further."

thridates the Great. But that prince being obliged to yield to Sylla, to Lucullus, and to Pompey, this and the other islands of the Archipelago submitted to the Romans, who reduced them to a province with Lydia, Phrygia, and Caria.

Mr Sutherland, who lately visited Paros, says, that "the water in it is excellent; and as that which we got at Messina has been complained of, as being too hard to make proper pease soup for the people, all the casks are ordered to be emptied and refilled. The Russians made this place their grand arsenal; their powder magazines, and several other buildings, are still standing; and the island is considerably indebted to them for improving the convenience for water, and for the trade which the cash they expended introduced among the inhabitants."

PAROTIDES, or Parotids, are glands situated on each side of the head. See Anatomy *Index*.

PAROXYSM, in *Medicine*, the severe fit of a disease, under which it grows higher or exasperated; as of the gout, &c.

PARR, Catharine, queen of England, was the eldest daughter of Sir Thomas Parr of Kendal. She was first married to John Nevil, Lord Latymer; after whose death, by her marriage with Henry VIII. she was raised to the throne. The royal nuptials were solemnized at Hampton Court on the 12th of July 1543. Being religiously disposed, she was, in the early part of her life, a zealous observer of the Romish rites and ceremonies; but in the dawning of the Reformation, she became as zealous a promoter of the Lutheran doctrine; yet with such prudence and circumspection as her perilous situation required. Nevertheless, we are told, that she was in great danger of falling a sacrifice to the Popish faction, the chief of whom was Bishop Gardiner: he drew up articles against her, and prevailed on the king to sign a warrant to remove her to the Tower. This warrant was, however, accidentally dropped, and immediately conveyed to her majesty. What her apprehensions must have been on this occasion may be easily imagined. She knew the monarch, and she could not help recollecting the fate of his former queens. A sudden illness was the natural consequence. The news of her indisposition brought the king to her apartment. He was lavish in expressions of affection, and sent her a physician. His majesty being soon after also somewhat indisposed, she prudently returned the visit; with which the king seemed pleased, and began to talk with her on religious subjects, proposing certain questions, concerning which he wanted her opinion. She answered, that such profound speculations were not suited to her sex; that it belonged to the husband to choose principles for his wife; the wife's duty was, in all cases, to adopt implicitly the sentiments of her husband; and as to herself, it was doubly her duty, being blessed with a husband who was qualified, by his judgment and learning, not only to choose principles for his own family, but for the most wise and knowing of every nation. "Not so, by St Mary," replied the king; "you are now become a doctor, Kate, and better fitted to give than receive instruction." She meekly replied, that she was sensible how little she was entitled to these praises; that though she usually declined not any conversation, however sublime, when proposed by his majesty, she well knew that her conceptions could serve to no other purpose than to give him a little momentary amusement; that she found the conversation a little apt to languish when not revived by some opposition, and she had ventured sometimes to feign a contrariety of sentiments, in order to give him the pleasure of refuting her; and that she also proposed, by this innocent artifice, to engage him into topics whence she had observed, by frequent experience, that she reaped profit and instruction. "And is it so, sweetheart?" replied the king; "then we are perfect friends again." He embraced her with great affection, and sent her away with assurances of his protection and kindness.

The time being now come when she was to be sent to the Tower, the king, walking in the garden, sent for the queen, and met her with great good humour; when lo the chancellor, with forty of the guards, approached. He fell upon his knees, and spoke softly with the king, who called him knave, arrant knave, beast, fool, and commanded him instantly to depart. Henry then returned to the queen, who ventured to intercede for the chancellor: "Ah, poor soul," said the king, "thou little knowest how evil he deserveth this grace at thy hands. Of my word, sweetheart, he hath been toward thee an arrant knave; and so let him go." The king died in January 1547, just three years and a half after his marriage with this second Catherine; who in a short time was again espoused to Sir Thomas Seymour lord-admiral of England; and in September 1548 she died in childbed. The historians of this period generally insinuate that she was poisoned by her husband, to make way for his marriage with the lady Elizabeth.

That Catherine Parr was beautiful is beyond a doubt: that she was pious and learned is evident from her writings; and that her prudence and sagacity were not inferior to her other accomplishments, may be concluded from her holding up the passion of a capricious tyrant as a shield against her enemies; and that at the latter end of his days, when his passions were enfeebled by age, and his peevish austerity increased by disease. She wrote, 1. Queen Catherine Parr's lamentation of a sinner, bewailing the ignorance of her blind life; Lond. 8vo. 1548, 1563. 2. Prayers or meditations, wherein the mynd is stirred patiently to suffre all afflictions here, to set at nought the vaine prosperitee of this worlde, and always to long for the everlastynge felicitee. Collected out of holy workes, by the most virtuous and gracious princesse Katherine, Queen of Englande, France, and Irelande. Printed by John Wayland, 1545, 4to,—1561, 12mo. 3. Other Meditations, Prayers, Letters, &c. unpublished.

Parr, *Thomas*, or *Old Parr*, a remarkable Englishman, who lived in the reigns of ten kings and queens; married a second wife when he was 120, and had a child by her. He was the son of John Parr, a husbandman of Winnington, in the parish of Alderbury, in the county of Salop, where he was born in the year 1483. Though he lived to the vast age of upwards of 152 years, yet the tenor of his life admitted but of little variety; nor can the detail of it be considered of importance, further than what will arise from the gratification of that curiosity which naturally inquires after the mode of living which could lengthen life to such extreme

extreme old age. Following the profession of his father, he laboured hard, and lived on coarse fare. Taylor the water poet says of him:

Good wholesome labour was his exercise,
Down with the lamb, and with the lark would rise;
In mire and toiling sweat he spent the day,
And to his team he whistled time away:
The cock his night-clock, and till day was done,
His watch and chief sun-dial was the sun.
He was of old Pythageras' opinion,
That green cheese was most wholesome with an onion;
Coarse messin bread, and for his daily swig,
Milk, butter milk, and water, whey, and whig:
Sometimes metheglin, and by fortune happy,
He sometimes sipp'd a cup of ale most nappy,
Cyder or perry, when he did repair
T' a Whitsun ale, wake, wedding, or a fair,
Or when in Christmas time he was a guest
At his good landlord's house among the rest:
Else he had little leisure time to waste,
Or at the alehouse huff-cap ale to taste.
Nor did he ever hunt a tavern fox;
Ne'er knew a coach, tobacco, or the ——.
His physic was good butter, which the soil
Of Salop yields, more sweet than Candy oil;
And garlic he esteem'd above the rate
Of Venice treacle or best mithridate.
He entertain'd no gout, no ache he felt,
The air was good and temperate where he dwelt;
While mavisses and sweet-tongued nightingales
Did chant him roundelays and madrigals.
Thus living within bounds of Nature's laws,
Of his long lasting life may be some cause.

And the same writer describes him in the following two lines:

From head to heel, his body had all over
A quick set, thick set, natural hairy cover.

The manner of his being conducted to London is also noticed in the following terms: "The right honourable Thomas earl of Arundel and Surrey, earl marshal of England, on being lately in Shropshire to visit some lands and manors which his lordship holds in that county, or for some other occasions of importance which caused his lordship to be there, the report of this aged man was signified to his honour, who hearing of so remarkable a piece of antiquity, his lordship was pleased to see him; and in his innate, noble, and Christian piety, he took him into his charitable tuition and protection, commanding that a litter and two horses (for the more easy carriage of a man so feeble and worn with age) to be provided for him; also, that a daughter of his, named Lucy, should likewise attend him, and have a horse for her own riding with him: and to cheer up the old man, and make him merry, there was an antique-faced fellow, with a high and mighty no-beard, that had also a horse for his carriage. These were all to be brought out of the country to London by easy journeys, the charge being allowed by his lordship; likewise one of his lordship's own servants, named Bryan Kelly, to ride on horseback with them, and to attend and defray all manner of reckonings and expences. All which was done accordingly as follows:—

"Winnington is a parish of Alderbury, near a place called the Welch Pool, eight miles from Shrewsbury: from whence he was carried to Wem, a town of the earl's aforesaid; and the next day to Shiffnall, a manor-house of his lordship's, where they likewise stayed one night: from Shiffnall they came to Wolverhampton, and the next day to Birmingham, and from thence to Coventry. Although Master Kelly had much to do to keep the people off, that pressed upon him in all places where he came, yet at Coventry he was most oppressed, for they came in such multitudes to see the old man, that those that defended him were almost quite tired and spent, and the aged man in danger of being stifled; and, in a word, the rabble were so unruly, that Bryan was in doubt he should bring his charge no farther; so greedy are the vulgar to hearken to or gaze after novelties. The trouble being over, the next day they passed to Daintree, to Stony Stratford, to Radburne, and so to London; where he was well entertained and accommodated with all things, having all the aforesaid attendance at the sole charge and cost of his lordship." When brought before the king, his majesty, with more acuteness than good manners, said to him, "You have lived longer than other men, what have you done more than other men?" He answered, "I did penance when I was a hundred years old." This journey, however, proved fatal to him; owing to the alteration in his diet, to the change of the air, and his general mode of life, he lived but a very short time, dying the 5th of November 1635 (A); and was buried in Westminster Abbey. After his death, his body was opened; and an account was drawn up by the celebrated Dr Harvey, part of which we shall lay before our readers.

"Thomas Parr was a poor country man of Shropshire, whence he was brought up to London by the right honourable Thomas earl of Arundel and Surrey; and died after he had outlived nine princes, in the tenth year of the tenth of them, at the age of 152 years and nine months.

"He had a large breast, lungs not fungous, but sticking to his ribs, and distended with blood; a lividness in his face, as he had a difficulty of breathing a little before his death, and a long lasting warmth in his armpits and breast after it; which sign, together with others, were so evident in his body, as they use to be on those that die by suffocation. His heart was great, thick, fibrous, and fat. The blood in the heart blackish and diluted. The cartilages of the sternum not more bony than in others, but flexile and soft. His viscera were sound and strong, especially the stomach; and it was observed of him, that he used to eat often by night and day, though contented with old

(A) The author of a book entitled *Long Livers*, 8vo. 1722, which Oldys in his MS. notes on Fuller ascribes to one Robert Samber, against all evidence says, p. 89. that Parr died sixteen years after he had been presented to the king, 24th of November 1651.

old cheese, milk, coarse bread, small beer, and whey; and, which is more remarkable, that he ate at midnight a little before he died. His kidneys were covered with fat, and pretty sound; only on the interior surface of them were found some aqueous or serous abscesses, whereof one was near the bigness of a hen egg, with a yellowish water in it, having made a roundish cavity, impressed on that kidney; whence some thought it came that a little before his death a suppression of urine had befallen him; though others were of opinion, that his urine was suppressed upon the regurgitation of all the serosity into his lungs. Not the least appearance there was of any stony matter either in the kidneys or bladder. His bowels were also sound, a little whitish without. His spleen very little, hardly equalling the bigness of one kidney. In short, all his inward parts appeared so healthy, that if he had not changed his diet and air, he might perhaps have lived a good while longer. The cause of his death was imputed chiefly to the change of food and air; forasmuch as coming out of a clear, thin, and free air, he came into the thick air of London; and after a constant plain and homely country diet, he was taken into a splendid family, where he fed high and drank plentifully of the best wines, whereupon the natural functions of the parts of his body were overcharged, his lungs obstructed, and the habit of the whole body quite disordered; upon which there could not but ensue a dissolution. His brain was sound, entire, and firm; and though he had not the use of his eyes, nor much of his memory, several years before he died, yet he had his hearing and apprehension very well; and was able, even to the 130th year of his age, to do any husbandman's work, even thrashing of corn.

The following summary of his life is copied from Oldys's MS. notes on Fuller's Worthies: Old Parr was born 1483; lived at home until 1500, æt. 17, when he went out to service. 1518, æt. 35, returned home from his master. 1522, æt. 39, spent four years on the remainder of his father's lease. 1543, æt. 60, ended the first lease he renewed of Mr Lewis Porter. 1563, æt. 80, married Jane, daughter of John Taylor, a maiden; by whom he had a son and a daughter, who both died very young. 1564, æt. 81, ended the second lease which he renewed of Mr John Porter. 1585, æt. 102, ended the third lease he had renewed of Mr Hugh Porter. 1588, æt. 105, did penance in Alderbury church, for lying with Katharine Milton, and getting her with child. 1595, æt. 112, he buried his wife Jane; after they had lived 32 years together. 1605, æt. 122, having lived 10 years a widower, he married Jane, widow of Anthony Adda, daughter of John Lloyd of Gilsells, in Montgomeryshire, who survived him. 1635, æt. 152, he died; after they had lived together 30 years, and after 50 years possession of his last lease. See Longevity.

PARRA, a genus of birds belonging to the order of grallæ. See Ornithology *Index*.

PARRELS, in a ship, are frames made of trucks, ribs, and ropes, which having both their ends fastened to the yards, are so contrived as to go round about the masts, that the yards by their means may go up and down upon the mast. These also, with the breast ropes, fasten the yards to the masts.

PARRET, or Pedred river, has its rise in the southern part of Somersetshire in England, and being joined by several other small rivers, the Evel; and about four miles from this junction, it is joined by the Tone or Thone, a pretty large river, rising among the hills in the western parts of this county. About two miles below the junction, it passes by the town of Bridgewater, and falls into the Bristol channel in Bridgewater bay.

PARRHASIUS, a famous ancient painter of Ephesus, or, as some say, of Athens: he flourished about the time of Socrates, according to Xenophon, who hath introduced him into a dialogue discoursing with that philosopher. He was one of the best painters in his time. Pliny says, that it was he who first gave symmetry and just proportions in that art; that he was likewise the first who knew how to express the truth and life of characters, and the different airs of the face; that he discovered a beautiful disposition of the hair, and heightened the grace of the visage. It is allowed even by the masters in the art, that he far outshone them in the glory of succeeding in the outlines, in which consists the grand secret of painting. But it is also remarked by Pliny, that Parrhasius became insupportable with pride; and was so very vain as to give himself the most flattering epithets; such as, the tenderest, the softest, the grandest, the most delicate, and the perfecter of his art. He boasted that he was sprung from Apollo, and that he was born to paint the gods; that he had actually drawn Hercules touch by touch, that hero having often appeared to him in dreams. When the plurality of voices was against him at Samos in favour of Timanthes, in the opinion of a picture of Ajax provoked against the Greeks, for adjudging to Ulysses the arms of Achilles, he answered a person who condoled him on his check, "For my part I don't trouble myself at the sentence; but I am sorry that the son of Telamon hath received a greater outrage than that which was formerly put upon him so unjustly." Ælian relates this story, and tells us that Parrhasius affected to wear a crown of gold upon his head, and to carry in his hand a batoon, studded with nails of the same metal. He worked at his art with pleasantry, often indeed singing. He was very licentious and loose in his pictures; and he is said, by way of amusement, to have represented the most infamous objects. His Atalantis, with her spouse Meleager, was of this kind. This piece was afterwards devised as a legacy to the emperor Tiberius, upon condition that, if he was displeased with the subject, he should receive a million sesterces instead of it. The emperor, covetous as he was, not only preferred the picture to that sum, but even placed it in his most favourite apartment. It is also said, that, though Parrhasius was excelled by Timanthes, yet he excelled Zeuxis. Among his pictures is a celebrated one of Theseus; and another representing Meleager, Hercules, and Perseus, in a group together; as also Æneas, with Castor and Pollux, in a third.

Parrhasius, *Janus*, a famous grammarian in Italy, who was born at Cosenza in the kingdom of Naples, 1470. He was intended for the law, the profession of his ancestors; but he refused it, and cultivated classical learning. His real name was Johannes Paulus Parisius; but according to the order of the grammarians of the age, he took instead of it Parrhasius. He taught at Milan with much reputation, being admired for a grace-

Parrhasius ‖ Parricide.

ful delivery, in which he chiefly excelled other professors.—It was this charm in his voice, which brought a vast concourse of people to his lectures; and among others he had the pleasure to see General Trimoles, who was then threescore years old. He went to Rome when Alexander VI. was pope; and was like to be involved in the misfortunes of Bernardini Cajetan and Silius Savello, with whom he had some correspondence; but he escaped the danger, by the information of Thomas Phœdrus, professor of rhetoric, and canon of St John Lateran, whose advice he followed in retiring from Rome. Soon after, he was appointed public professor of rhetoric at Milan; but the liberty he took to censure the teachers there as arrant blockheads, provoked them in return to asperse his morals. They said he had a criminal converse with his scholars: which being a crime extremely abhorred by the Milanese, our professor was obliged to leave Milan. He went to Vicenza, where he obtained a larger salary; and he held this professorship till the states of the Venetians were laid waste by the troops of the League: upon which he went to his native country, having made his escape through the army of the enemy. He was at Cosenza, when his old friend Phœdrus persuaded Julius to send for him to Rome; and though that design proved abortive by the death of the pope, yet, by the recommendation of John Lascaris, he was called thither under his successor Leo X. Leo was before favourably inclined to him; and on his arrival at Rome, appointed him professor of polite literature. He had been now some time married to a daughter of Demetrius Chalcondylas; and he took with him to Rome, Basil Chalcondylas, his wife's brother, and brother of Demetrius Chalcondylas, professor of the Greek tongue at Milan. He did not long enjoy this office conferred upon him by the pope; for, worn out by his studies and labours, he became so afflicted with the gout, that for some years he had no part of his body free, except his tongue: having almost lost the use of both his legs and both his arms. He laboured besides under so great a degree of poverty, as put him out of all hopes of being ever in a better situation; so that he left Rome, and returned into Calabria, his native country, where he was tormented a long while with a fever, and at last died in the greatest misery. He left his library to his friend Seripandus, brother to Cardinal Jerome Seripandus, who built him a tomb in the convent of the Austin friars at Naples There are several books ascribed to him; and in the dedication of one of them, his character is drawn to great advantage by Henry Stephens.

PARRHESIA. See ORATORY, N° 88.

PARRICIDE, the murder of one's parents or children. By the Roman law, it was punished in a much severer manner than any other kind of homicide. After being scourged, the delinquents were sewed up in a leathern sack, with a live dog, a cock, a viper, and an ape, and so cast into the sea. Solon, it is true, in his laws, made none against parricide; apprehending it impossible that one should be guilty of so unnatural a barbarity. And the Persians, according to Herodotus, entertained the same notion, when they adjudged all persons who killed their reputed parents to be bastards. And upon some such reason as this must we account for the omission of an exemplary punishment for this crime in our English laws; which treat it no otherwise than as simple murder, unless the child was also the servant of the parent.

Parricide ‖ Parson.

For though the breach of natural relation is unobserved, yet the breach of civil or ecclesiastical connexions, when coupled with murder, denominates it a new offence; no less than a species of treason, called *parva proditio*, or *petit treason;* which, however, is nothing else but an aggravated degree of murder; although, on account of the violation of private allegiance, it is stigmatized as an inferior species of treason. And thus, in the ancient Gothic constitution, we find the breach both of natural and civil relations ranked in the same class with crimes against the state and sovereign.

PARROT. See PSITTACUS, ORNITHOLOGY *Index*.

PARSHORE, a town of England in Worcestershire, seven miles from Worcester, and 102 from London, situated on the north side of the Avon, near its junction with the river Bow, being a considerable thoroughfare in the lower road from Worcester to London. A religious house was founded here in 604, a small part of which now remains, and is used as the parish church of Holy Cross, the whole of which contained above 10 acres. The abbey church was 250 feet long, and 120 broad. The parish of Parshore is of great extent, and hath within its limits many manors and chapelries. At present it has two parishes, Holy Cross and St Andrew. In Holy Cross church are several very antique monuments. Its chief manufacture is stockings. It contained 2179 inhabitants in 1811.

PARSLEY. See APIUM, BOTANY *Index*.

PARSNEP. See PASTINACA, BOTANY *Index*.

PARSON *and* VICAR. A parson, *persona ecclesiæ*, is one that hath full possession of all the rights of a parochial church. He is called parson, *persona*, because by his person the church, which is an invisible body, is represented; and he is in himself a body corporate, in order to protect and defend the rights of the church (which he personates) by a perpetual succession. He is sometimes called the *rector* or *governor* of the church; but the appellation of *parson* (however it may be depreciated by familiar, clownish, and indiscriminate use) is the most legal, most beneficial, and most honourable title that a parish priest can enjoy; because such a one (Sir Edward Coke observes), and he only, is said *vicem seu personam ecclesiæ gerere*. A parson has, during his life, the freehold in himself of the parsonage house, the glebe, the tithes, and other dues. But these are sometimes *appropriated;* that is to say, the benefice is perpetually annexed to some spiritual corporation, either sole or aggregate, being the patron of the living; whom the law esteems equally capable of providing for the service of the church as any single private clergyman *. Blackst. Comment.

The appropriating corporations, or religious houses, were wont to depute one of their own body to perform divine service, and administer the sacraments, in those parishes of which the society was thus the parson. This officiating minister was in reality no more than a curate, deputy, or vicegerent of the appropriator, and therefore called *vicarius*, or "vicar." His stipend was at the discretion of the appropriator, who was, however, bound of common right to find somebody, *qui illi de temporalibus, episcopo de spiritualibus, debeat respondere.* But this

* See Appropriation.

Parson.

this was done in so scandalous a manner, and the parishes suffered so much by the neglect of the appropriators, that the legislature was forced to interpose: and accordingly it is enacted, by statute 15 Rich. II. c. 6. that in all appropriations of churches the diocesan bishop shall ordain (in proportion to the value of the church) a competent sum to be distributed among the poor parishioners annually; and that the vicarage shall be sufficiently endowed. It seems the parish were frequently sufferers, not only by the want of divine service, but also by withholding those alms for which, among other purposes, the payment of tithes was originally imposed: and therefore in this act a pension is directed to be distributed among the poor parochians, as well as a sufficient stipend to the vicar. But he, being liable to be removed at the pleasure of the appropriator, was not likely to insist too rigidly on the legal sufficiency of the stipend; and therefore, by statute 4 Hen. IV. c. 12. it is ordained, that the vicar shall be a secular person, not a member of any religious house; that he shall be vicar perpetual, not removeable at the caprice of the monastery; and that he should be canonically instituted and inducted, and be sufficiently endowed, at the discretion of the ordinary; for these three express purposes, to do divine service, to inform the people, and to keep hospitality. The endowments, in consequence of these statutes, have usually been by a portion of the glebe, or land belonging to the parsonage, and a particular share of the tithes, which the appropriators found it most troublesome to collect, and which are therefore generally called *petty* or *small tithes;* the greater, or predial tithes, being still reserved to their own use. But one and the same rule was not observed in the endowment of all vicarages. Hence some are more liberally, and some more scantily, endowed: and hence the tithes of many things, as wood in particular, are in some parishes rectorial, and in some vicarial tithes.

The distinction therefore of a parson and vicar is this: The parson has for the most part the whole right to all the ecclesiastical dues in his parish; but a vicar has generally an appropriator over him, entitled to the best part of the profits, to whom he is in effect perpetual curate, with a standing salary. Though in some places the vicarage has been considerably augmented by a large share of the great tithes; which augmentations were greatly assisted by the statute 27 Car. II. c. 8. enacted in favour of poor vicars and curates, which rendered such temporary augmentations (when made by the appropriators) perpetual.

The method of becoming a parson or vicar is much the same. To both there are four requisites necessary; holy orders, presentation, institution, and induction. The method of conferring the holy orders of deacon and priest, according to the liturgy and canons, is foreign to the present purpose; any farther than as they are necessary requisites to make a complete parson or vicar. By common law, a deacon, of any age, might be instituted and inducted to a parsonage or vicarage; but it was ordained, by statute 13 Eliz. c. 12. that no person under twenty-three years of age, and in deacon's orders, should be presented to any benefice with cure; and if he were not ordained priest within one year after his induction, he should be *ipso facto* deprived: and now, by statute 13 and 14 Car. II. c. 4. no person is capable to be admitted to any benefice, unless he hath been first ordained a priest; and then he is, in the language of the law, a clerk in orders. But if he obtains orders, or a license to preach, by money or corrupt practices, (which seems to be the true, though not the common, notion of simony), the person giving such orders forfeits 40l. and the person receiving, 10l. and is incapable of any ecclesiastical preferment for seven years after.

Any clerk may be presented to a parsonage or vicarage; that is, the patron, to whom the advowson of the church belongs, may offer his clerk to the bishop of the diocese to be instituted. But when he is presented, the bishop may refuse him upon many accounts. As, 1. If the patron is excommunicated, and remains in contempt 40 days; or, 2. If the clerk be unfit: which unfitness is of several kinds. First, With regard to his person; as if he be a bastard, an outlaw, an excommunicate, an alien, under age, or the like. Next, With regard to his faith or morals: as for any particular heresy, or vice that is *malum in se;* but if the bishop alleges only in generals, as that he is *schismaticus inveteratus*, or objects a fault that is *malum prohibitum* merely, as haunting taverns, playing at unlawful games, or the like, it is not good cause of refusal. Or, lastly, The clerk may be unfit to discharge the pastoral office for want of learning. In any of which cases, the bishop may refuse the clerk. In case the refusal is for heresy, schism, inability of learning, or other matter of ecclesiastical cognizance, there the bishop must give notice to the patron of such his cause of refusal, who being usually a layman, is not supposed to have knowledge of it; else he cannot present by lapse; but if the cause be temporal, there he is not bound to give notice.

If an action at law be brought by the patron against the bishop for refusing his clerk, the bishop must assign the cause. If the cause be of a temporal nature, and the fact admitted (as, for instance, outlawry), the judges of the king's courts must determine its validity, or whether it be sufficient cause of refusal: but if the fact be denied, it must be determined by a jury. If the cause be of a spiritual nature, (as heresy, particularly alleged) the fact, if denied, shall also be determined by a jury: and if the fact be admitted or found, the court, upon consultation and advice of learned divines, shall decide its sufficiency. If the cause be want of learning, the bishop need not specify in what points the clerk is deficient, but only allege that he is deficient; for the statute 9 Edw. II. st. 1. c. 13. is express, that the examination of the fitness of a person presented to a benefice belongs to the ecclesiastical judge. But because it would be nugatory in this case to demand the reason of refusal from the ordinary, if the patron were bound to abide by his determination, who has already pronounced his clerk unfit; therefore if the bishop return the clerk to be *minus sufficiens in literatura*, the court shall write to the metropolitan to re-examine him, and certify his qualifications; which certificate of the archbishop is final.

If the bishop hath no objections, but admits the patron's presentation, the clerk so admitted is next to be instituted by him; which is a kind of investiture of the spiritual part of the benefice; for by institution, the care of the souls of the parish is committed to the charge of the clerk. When a vicar is instituted, he (besides the usual

usual forms) takes, if required by the bishop, an oath of perpetual residence; for the maxim of law is, that *vicarius non habet vicarium*: and as the non-residence of the appropriators was the cause of the perpetual establishment of vicarages, the law judges it very improper for them to defeat the end of their constitution, and by absence to create the very mischief which they were appointed to remedy; especially as, if any profits are to arise from putting in a curate and living at a distance from the parish, the appropriator, who is the real parson, has undoubtedly the elder title to them. When the ordinary is also the patron, and confers the living, the presentation and institution are one and the same act, and are called a *collation to a benefice*. By institution or collation the church is full, so that there can be no fresh presentation till another vacancy, at least in the case of a common patron; but the church is not full against the king till induction: nay, even if a clerk is instituted upon the king's presentation, the crown may revoke it before induction and present another clerk. Upon institution also the clerk may enter on the parsonage house and glebe, and take the tithes: but he cannot grant or let them, or bring an action for them, till induction. See INDUCTION.

For the rights of a parson or vicar, in his tithes and ecclesiastical dues, see TITHES. As to his duties, they are so numerous, that it is impracticable to recite them here with any tolerable conciseness or accuracy; but the reader who has occasion may consult *Bishop Gibson's Codex*, *Johnson's Clergyman's Vade Mecum*, and *Burn's Ecclesiastical Law*. We shall therefore only just mention the article of residence, upon the supposition of which the law doth style every parochial minister an incumbent. By statute 21 Henry VIII. c. 13. persons willingly absenting themselves from their benefices, for one month together, or two months in the year, incur a penalty of 5l. to the king, and 5l. to any person that will sue for the same; except chaplains to the king, or others therein mentioned, during their attendance in the household of such as retain them; and also except all heads of houses, magistrates, and professors in the universities, and all students under forty years of age residing there, *bona fide*, for study. Legal residence is not only in the parish, but also in the parsonage house; for it hath been resolved, that the statute intended residence, not only for serving the cure and for hospitality, but also for maintaining the house, that the successor also may keep hospitality there.

We have seen that there is but one way whereby one may become a parson or vicar: there are many ways by which one may cease to be so. 1. By death. 2. By cession, in taking another benefice; for by statute 21 Hen. VIII. c. 13. if any one having a benefice of 8l. per annum, or upwards, in the king's books, (according to the present valuation), accepts any other, the first shall be adjudged void, unless he obtains a dispensation; which no one is entitled to have but the chaplains of the king and others therein mentioned, the brethren and sons of lords and knights, and doctors and bachelors of divinity and law, admitted by the universities of this realm. And a vacance thus made for want of a dispensation, is called *cession*. 3. By consecration; for, as was mentioned before, when a clerk is promoted to a bishopric, all his other preferments are void the instant that he is consecrated. But there is a method, by the favour of the crown, of holding such livings *in commendam*. *Commenda*, or *ecclesia commendata*, is a living commended by the crown to the care of a clerk, to hold till a proper pastor is provided for it. This may be temporary for one, two, or three years, or perpetual, being a kind of dispensation to avoid the vacancy of the living, and is called a *commenda retinere*. There is also a *commenda recipere*, which is to take a benefice *de novo*, in the bishop's own gift, or the gift of some other patron consenting to the same; and this is the same to him as institution and induction are to another clerk. 4. By resignation. But this is of no avail till accepted by the ordinary, into whose hands the resignation must be made. 5. By deprivation, either by canonical censures, or in pursuance of divers penal statutes, which declare the benefice void, for some nonfeasance or neglect, or else some malefeasance or crime: as for simony; for maintaining any doctrine in derogation of the king's supremacy, or of the thirty-nine articles, or of the book of common prayer; for neglecting after institution to read the liturgy and articles in the church, or make the declarations against Popery, or to take the abjuration oath; for using any other form of prayer than the liturgy of the church of England; or for absenting himself 60 days in one year from a benefice belonging to a Popish patron, to which the clerk was presented by either of the universities: in all which, and similar cases, the benefice is *ipso facto* void, without any formal sentence of deprivation.

PARSONAGE, a rectory, or parish church, endowed with a glebe, house, lands, tithes, &c. for the maintenance of a minister, with cure of souls within such parish. See PARSON.

PART, a portion of some whole, considered as divided or divisible.

Logical PART, is a division for which we are indebted to the schoolmen. It refers to some universal as its whole; in which sense the species are parts of a genus, and individuals or singulars are parts of the species.

Physical PART, is that which, though it enter the composition of a whole, may yet be considered apart, and under its own distinct idea; in which sense, a continuum is said to consist of parts. Physical parts, again, are of two kinds, homogeneous and heterogeneous; the first are those of the same denomination with some other; the second of a different one: See HOMOGENEOUS, &c. Parts, again, are distinguished into subjective, essential, and integrant. The schoolmen were also the authors of this division.

Aliquot PART, is a quantity which, being repeated any number of times, becomes equal to an integer. Thus 6 is an aliquot part of 24, and 5 an aliquot part of 30, &c.

Aliquant PART, is a quantity, which, being repeated any number of times, becomes always either greater or less than the whole. Thus 5 is an aliquant part of 17, and 9 an aliquant part of 10, &c.

The aliquant part is resolvable into aliquot parts. Thus 15, an aliquant part of 20, is resolvable into 10, a half, and 5 a fourth part of the same.

PARTS *of Speech*, in *Grammar*, are all the sorts of words which can enter the composition of a discourse. See GRAMMAR.

PARTERRE, in *Gardening*, a level division of ground, Parterre.

ground, which for the most part faces the south, or best front of a house, and is generally furnished with evergreens, flowers, &c. There are two kinds of these, the plain ones and the parterres of embroidery.

Plain parterres are most valuable in England, because of the firmness of the English turf, which is superior to that of any other part of the world; and the parterres of embroidery are cut into shell and scroll work, with alleys between them. An oblong, or long square, is accounted the most proper figure for a parterre; and a parterre should indeed be always twice as long as it is broad, because, according to the known laws of perspective, a long square always sinks to a square; and an exact square always appears less than it really is. As to the breadth of parterre, it is to be proportionable to the front of the house; but less than 100 feet in breadth is too little.

There should be on each side the parterre a terrace walk raised for a view, and the flat of the parterre between the terraces should never be more than 300 feet, at the utmost, in breadth; and about 140 feet in width, with twice and a half that in length, is esteemed a very good size and proportion.

Parterre, Parthenium.

PARTHENIUM, a genus of plants, belonging to the monœcia class, and in the natural method ranking under the 49th order, *Compositæ*, See BOTANY *Index*.

END OF THE FIFTEENTH VOLUME.

DIRECTIONS FOR PLACING THE PLATES OF VOL. XV.

PART I.

PART II.